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ON THE COVER: Getting started in drone flying is easier than you might think! Whether you're interested in drone racing or aerial videography and photography, we have what you need to know in this month's feature. (Photo by Carl Hyndman)

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Preflight

BY DEBRA CLEGHORN | EXECUTIVE EDITOR

RC Old and New

WELCOME TO OUR FIRST ISSUE OF 2017, in which we showcase the newest—and models of some of the oldest—RC aircraft around. In our "Getting Started in Drones" feature, we share what you need to know to get started in either aerial videography or drone racing—two exciting but vastly different and specialized platforms—and we highlight our top picks in both categories. In our coverage of the 50th anniversary of the Old Rhinebeck World War I Jamboree, we celebrate the planes and the people who have made this fly-in so successful for a full half-century. From Cole Palen's small 35-year-old free-flight model to half-scale WW I biplanes, this year's Jamboree had it all.

If you're looking for a winter building project, we're sure that you'll find that perfect plane in this month's special Plans Guide—which features 140 of the best *Model Airplane News* plans ever published. The guide is chock full of great winter projects, from quick-build electric park fliers to fully detailed giant-scale warbirds and everything in between. And many of our plans have an online construction article with photos and building details (ModelAirplaneNews.com/plans). Whether you're an expert builder or just starting out, we're confident that you'll find a rewarding project here. For a complete, searchable directory of more than 700 *Model Airplane News* plans, go to AirAgeStore.com. We hope that you enjoy your building time this winter, and when your pride and joy is complete, please remember to send us a photo for Pilot Projects (send it to us preflight—just in case!).

Since 1929, *Model Airplane News* has had a single mission: to engage, inspire, and inform our readers. We're always interested in hearing what you'd like to see more (or less) of in future issues. Send your emails to MAN@airage.com, or leave a comment on our Facebook page. We'll use your feedback to help keep *Model Airplane News* at the top of your reading list! We hope that you enjoy this first issue of 2017, and we hope to see you on the flightline soon.

Top: Senior Technical Editor Gerry Yarrish's Triplane flies at the 50th Old Rhinebeck WW I Jamboree. Right: The Yuneec Typhoon H camera drone is an ideal platform for intermediate aerial photographers/ videographers.

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EDITORIAL
Executive Editor Debra Cleghorn » debrac@airage.com
Senior Technical Editor Gerry Yarrish » gerryy@airage.com
West Coast Senior Editor John Reid » johnr@airage.com
Associate Editor Matt Boyd » mattb@airage.com
Copy Editor Suzanne Noel

CONTRIBUTORS
Jason Benson, Sal Calvagna, Budd Davisson, Don Edberg, Mike Gantt, Dave Garwood, Dave Gierke, Greg Gimlick, John Glezellis, Aaron Ham, Carl Layden, Clarence Lee, Jim Newman, Greg Poppel, Mark Rittinger, Jim Ryan, David Scott, Jerry Smith, Craig Trachten, Paul Tradelius, Pat Tritle, Rich Uravitch, Nick Ziroli Sr.

ART
Creative Director Betty K. Nero
Art Director Kevin Monahan

DIGITAL MEDIA
Web Producer Holly Hansen

VIDEO/PHOTOGRAPHY
Photographer Peter Hall
Videographer Adam Lebenstein

ADVERTISING
Director Advertising & Marketing David J. Glaski
»203.529.4637 | davidg@airage.com
Strategic Account Manager Mitch Brian
»203.529.4609 | mitchb@airage.com
Senior Account Executive Ben Halladay
»203.529.4628 | benh@airage.com

CONSUMER MARKETING/PRODUCTION
The Media Source, a division of TEN, The Enthusiast Network

MARKETING & EVENTS
Marketing Assistant Erica Driver
Event Manager Emil DeFrancesco

PUBLISHING
Group Publishers Louis V. DeFrancesco Jr., Yvonne M. DeFrancesco

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EMAIL MAN@airage.com
PHONE (203) 529-4635

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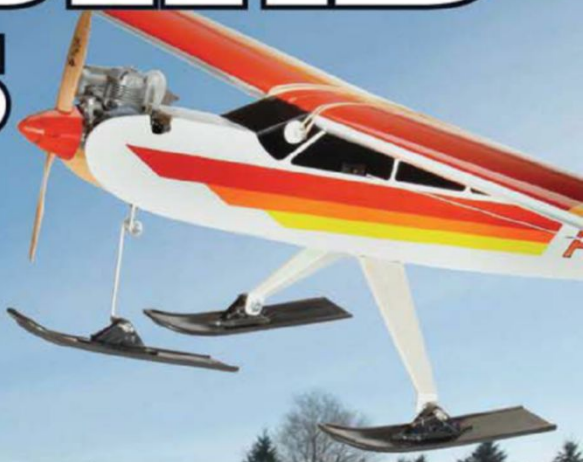

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YOUR FEEDBACK

We love hearing from our readers: Your emails, tweets, and comments quickly let us know what you'd like to see more (or less!) of in upcoming issues and online. Here's what some of you are saying about *Model Airplane News* magazine.

Facebook

Aileron Differential: How to Set Up Your Plane

Without aileron differential, most airplanes require a certain amount of coordinated rudder to prevent, or at least minimize, adverse yaw while the model is banking through a turn. We recently posted Aerobatics Made Easy columnist John Glezellis' article on the subject and it generated some interesting comments. Here are just a few.

SS: I read somewhere that the only reason the rudder exists is to combat the adverse yaw effect of a propeller plane.

AB: I started getting serious about aerobatics last year. I found the post very helpful.

RW: Does it work on flying wings? Mine doesn't spin well.

CP: I never understood this phenomenon until I learned to fly full scale. Very evident when your sitting in the seat.

FH: Or...learn to use the rudder.

ModelAirplaneNews.com

Speedy Green Machine: Jet-Powered Gee Bee

Wait...What?! A jet-powered Gee Bee racer? Yep, you read that right. We recently posted a video on our Facebook page, and it scored a lot of comments from you all. Here's the basic info. The model was built from a 1/3-scale CARF-Models kit, and it is powered by a Frankturbine FT 250 turbine engine. It has a wingspan of 92.4 inches, is 74 inches long, and weighs 48.5 pounds. The video is courtesy of RC Media World and was shot at the JetPower Fair in Bad Neuenahr-Ahrweiler, Germany, in 2016. The pilot is Christian Göbel.

Vic Minetola: Wow, what a ride! And retracts too. Well flown. Looked like it didn't want to come down—used up all the runway.

Mark Erickson: They say it is 1/3.2 scale, but isn't it hard to build a scale model of something that never existed? Just saying.

Jose Fabian: Amazing—airplane, pilot, and landing.

Lee: The guy needs some flaps mix and expo on his elevator.

Peter Kolesar Jr.: I have to say, this Turbine Gee Bee is bad to the bone. Unique and different.

In Our Mailbox

Scale Special Issue

I just finished reading your December issue, and I wanted to say that I absolutely love your Scale special issue—in particular, Lyle Vasser's article on detailing scale pilot-figure faces. I never thought of using pastels, but you can't argue with Lyle's results. Well done!—*Michael Watkins*

Michael, thanks for writing. We will pass on your comments to Lyle. As owner/operator of Best Pilots, Lyle knows what he's talking about.—*GY*

CORRECTION

In our article on Phil Clark's monster-scale Skyraider, published in the December 2016 issue, I incorrectly indicated that the 30%-scale warbird, the subject of the impressive RC project, belonged to Phil Clark. In actuality, the 180-inch-span Douglas Skyraider project was commissioned by Ali Machinchy, who enlisted Phil Clark to build it for him. He did not purchase the aircraft for Phil as I had indicated. I apologize for this mistake and any misunderstandings it might have caused.—*GY*

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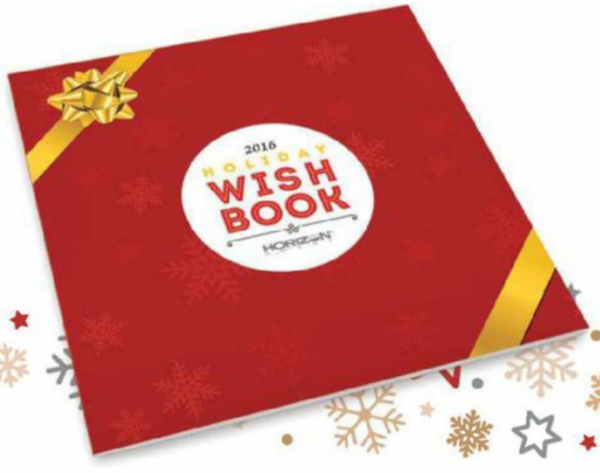

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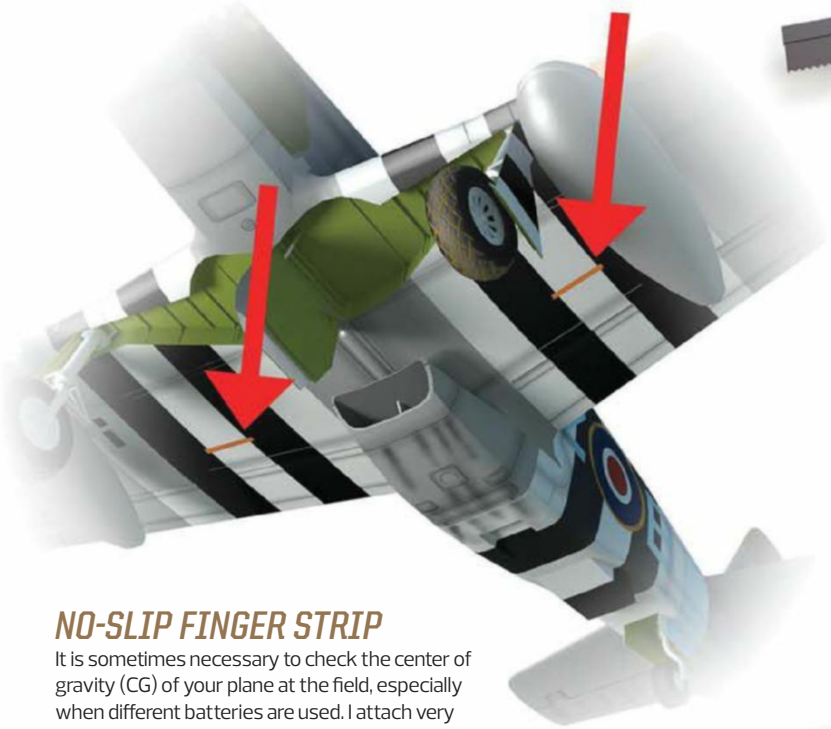


NO-SLIP FINGER STRIP

It is sometimes necessary to check the center of gravity (CG) of your plane at the field, especially when different batteries are used. I attach very narrow strips of self-adhesive sandpaper to the bottom of the wings at the recommended CG. These prevent my fingers from slipping, and they are then easy to find without visually searching for special marks.

Yuliy Lieb, Newport Beach, CA

FLAT-BLADE SAW

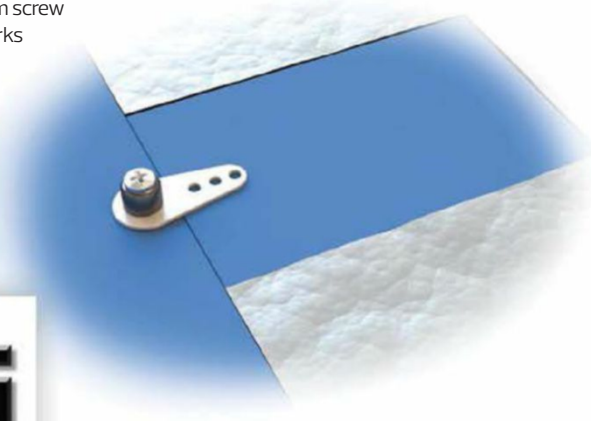
One of my favorite workbench tools, this small flat-blade handsaw is made from an old Zona hobby saw and a piece of 3/4-inch dowel. I removed the back channel from the Zona saw, allowing it to make thin, deep cuts for removable battery hatches. It is easy to remove the stiffener channel from the blade, cut a slot in a piece of the dowel handle, and slide the blade into place and glue it with CA.

Dennis Sumner, Canton, MI

SIMPLE LATCH

I lost the thumb latch from one of my electric-powered airplanes that holds the battery-compartment hatch in place. There were no replacement parts available, so I took a Du-Bro replacement servo arm and used a servo-arm screw to hold it in place. Works like a charm.

Craig Trachten, New Milford, CT



ULTIMATE SANDING BLOCK

Here is the greatest thing for sanding the finish of a model airplane. Dura-Block sanding blocks make finish sanding a snap. They are made out of hard rubber and are available in auto-body and paint-supply stores. They come in various lengths up to 30 inches and are about 2 3/4 inches wide. They accept self-stick abrasive strips, which can be quickly replaced to change grits. The great thing about the sanding strips is that they are "no load." I have sanded over cured epoxy, CA adhesives, glue, and dope, and nothing adheres to or fills up the abrasive strips. The sanding dust just brushes off. In addition, you can use Dura-Block strips on narrow aluminum sanding bars. The extra width easily curls up over the edges to keep them from gouging ribs and spar edges.

Kent Garrett, Turner, OR

SEND IN YOUR IDEAS! We want your ideas for Tips & Tricks! This month's winners will receive a $50 glue assortment from Bob Smith Industries. Send a photo or rough sketch and a brief description to MAN@airage.com or *Model Airplane News*, c/o Air Age Media, 88 Danbury Rd., Wilton, CT 06897 USA.

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PT-17

Dorothea Thomas, Aurora, CO

Built from a Top Flite kit, this PT-17 is powered by a DLE-35RA gas engine spinning a 10x8 Xoar prop, and it can put on a show with its Sullivan smoke system and a female pilot from warbirdpilots.com. Dorothea notes that she's in the process of adding the functional flying wires and that her husband helped with the assembly. She adds, "I am the only fixed-wing female pilot in our club. Loving it." Brava, Dorothea!

RHETT MILLER COMPENSATOR

Nick Ziegler, Moline, IL

After finding this 35-year-old model, Nick, his brother, and his father restored it by stripping out the equipment and cover and adding Hitec servos, Futaba radio gear, and a Novarossi R60F engine. The plane has its original B&D retracts, spinner, and pilot bust. Nick says that it's a real attention getter and flies "like it's on rails" at 130mph!

ALON AIRCOUPE

Alain Adam, Metamora, MI

Alain built this 63-inch-span flier from a Jack Stafford Models kit with the help of his friend Bob Gardner. It's powered by an O.S. FS .40 four-stroke inverted engine with onboard glow and controlled by a Futaba radio. Alain adds, "It truly is a joy to fly and beautiful to watch in the air with its twin fins."

CLOUD CRUISER

David Trogdon, Whiteville, NC

Built from Ben Shereshaw's 1937 plans, this vintage replica is powered by an O.S. .55 AX engine and uses a JR XP622 radio. David writes, "I didn't want to hide all the beautiful structure, so I covered this 8-foot-span beauty in transparent yellow UltraCote."

SEND IN YOUR PICTURES! *Model Airplane News* is your magazine, and we encourage reader participation. Email your high-resolution images to MAN@airage.com with your contact information and details on your project. Every pilot we feature will receive a *Model Airplane News* baseball cap, and the "Pilot Project of the Month" winner will receive a $200 gift code for anything at jramericas.com.

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The 50th-Anniversary World War I Jamboree

A half-century of RC fun at the Old Rhinebeck Aerodrome

BY **GERRY YARRISH** PHOTOS BY **TIM HAGGERTY & GERRY YARRISH**

The big sod runway at the Old Rhinebeck Aerodrome is one of the greatest flying venues in the country. Add full-size vintage aircraft and it's simply magical!

The fun starts even before you arrive at the Aerodrome. How's this for a road sign?

If you're involved in RC for any length of time, there are those events that instantly come to mind when you think about our hobby. Perhaps the most famous is the annual WW I Jamboree hosted by the Mid-Hudson Radio Control Society. This amazing event is held each year at the Old Rhinebeck Aerodrome (ORA). Cole Palen, founder of the ORA, literally built this world-class aviation museum with his own two hands, and it has become home for dozens of classic and rare aircraft. Created in the mid-'60s, the ORA not only houses these rare birds but also, thanks to its talented staff, keeps many of them in flying condition to perform in the weekend airshows.

Morning Free-Flight Launch

A longtime tradition for the Jamboree is the early-morning mass launch of stick-and-tissue free-flight models. To start off this free-flight launch, a member of the ORA ground crew honors Cole Palen, who was also a free-flight model builder, and then launches one of Cole's original 35+-year-old models. Open to any and all who bring a model, there are no awards given out, but it feels great to take part in this simple yet important tribute to the man who started it all.

The early-morning rubber-powered free-flight mass launch is a tradition at the Jamboree.

Happy Anniversary

Trailers and tents started populating the flightline as early as the Sunday before the event week, and pilots came from as far away as Indiana and Florida to attend. Some also made the southern trek from various Canadian provinces to enjoy the early-aviation festivities. With well over 200 aircraft and about 3,000 spectators packing the runway benches, this year's 50th anniversary of the Jamboree was a big success. A regular stop for many vintage RC modelers and pilots, the Jamboree is much more than just a fun-fly event. It is a unique venue where RC and full-size aviation come together in a very special way. Celebrated on September 9–11, this year's event also drew several veteran modelers who had actually competed at the very first Jamboree.

During the Saturday evening banquet, held in the main museum hangar, Nick Ziroli Sr. gave a talk and slideshow about his personal modeling history and his involvement with the annual event. Also at the dinner, Bob Noll brought his scale Nieuport 28 that he flew to win the very first competition. Bob also spoke on behalf of Dick Allen, who helped organize the original event but was unable to attend this year. Balsa USA, a regular fixture at the Jamboree, also received an award from the Academy of Model Aeronautics (AMA) recognizing the company's many years of support for the Aerodrome and the event.

Bob Noll with his Nieuport 28, the one he flew and won with at the first Jamboree 50 years ago. It's still in great shape. (Photo by Tom Polapink)

Nick Ziroli Sr. spoke to the audience about the first WW I Jamboree and his involvement with the hobby.

RC Airshow

Flying starts each day after the pilots' meeting, and it continues after the full-size airshow well into the twilight hours. There's no size restriction, and as long as your model is of an aeroplane that flew before 1939, you're welcome at the Aerodrome. The RC fun-fly portion ends at 2 p.m., when the full-size airshow begins. The airshow is first kicked off by several giant-scale RC airplanes flying demonstration flights. Orchestrated by Ken Hall, this year's RC presentation included a formation flight of two half-scale Nieuports (an N28 and an N11), flown by builder Keith Zimmerly and his wingman Ben Haggerty. It was difficult to distinguish the sight and sound of these 50%-scale beauties from the real thing.

Following the big Nieuports was another formation flight flown by two vintage twin-engine biplane bombers. The first in the air was a 17-foot-span WW I German Gotha G.IV, designed and flown by Greg Hahn. The other was an equally impressive 14-foot-span Curtiss B-2 Condor, built and piloted by Curtis Switzer. Just like the full-size aircraft, both bombers were loaded with bombs, and there were many direct hits on the Mission target in the middle of the runway.

The rest of the RC airshow was populated with large-scale models, many of which were copies of full-size aircraft that call ORA home. These included a DH.82 Tiger Moth, a Fokker D.VIII "Flying Razor," a pair of Fokker D.VIIs, and a Sopwith Pup—all in 1/3 scale.

Mike Gross Sr. brought his unusual 1/3-scale Siemens-Schuckert D.IV fighter to the Jamboree and put in some exciting smoke-trailing flights.

This beautiful rendition of Cole Palen's earlier Fokker D.VII is the work of Bob Allen.

Curtis Switzer received the Best Golden Age award with his impressive Curtiss B-2 Condor bomber.

The replica Curtiss Model D ("Curtiss Pusher") also made a sustained low level hop for the crowd!

Full-Size Aviation

It all comes into focus when the full-size occupants of the Aerodrome roar to life and the aviation history lessons began. With the help of airshow announcer Jim Hare, the weekend was filled with vintage aircraft. It's an awesome opportunity to see (and hear) antique aeroplanes show off and strut their stuff; there are few other places to see such a demonstration. Two new additions to the ORA fleet were the just-completed replica of the Ryan Spirit of St. Louis, of Charles Lindbergh fame, and a Sopwith Pup replica, both of which taxied down the runway so that the audience could hear their impressive engines sing. Airshow regulars included an original 1909 French Blériot XI, the replica 1911 Curtiss Model D ("Curtiss Pusher"), and the replica 1910 French Hanriot. Taking flight during several barnstorming maneuvers were a Curtiss-Wright CW-1 Junior, a de Havilland DH.82 Tiger Moth, two replica Fokker Dr.1 Triplanes, a Curtiss Robin cabin monoplane, a replica Fokker D.VII, a Piper J-3 Cub, and an original New Standard D-25, which also gave biplane rides during the weekend.

To the delight of everyone, there was a pair of full–size Fokker Triplanes at the Jamboree.

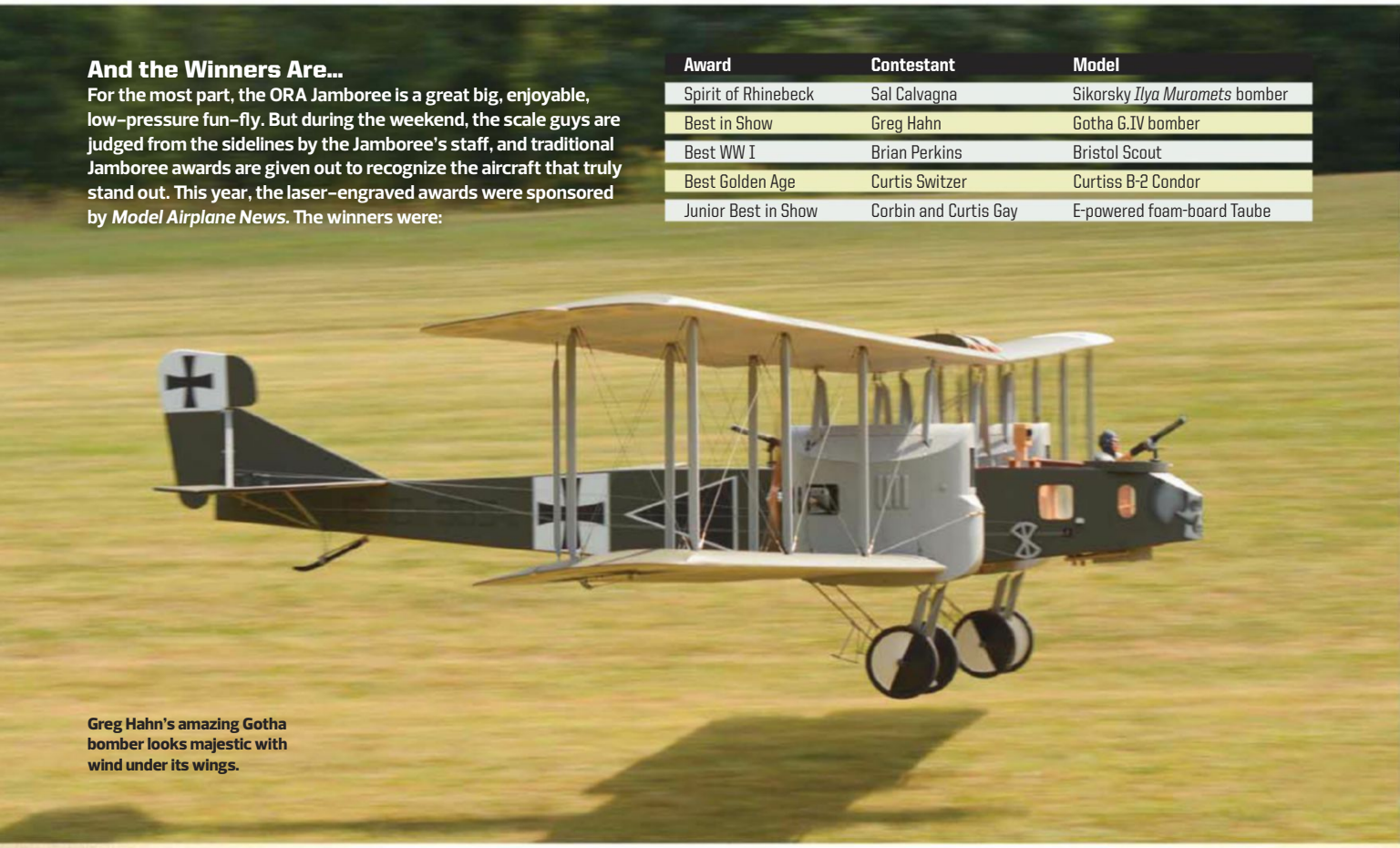
The newly completed Ryan Spirit of St. Louis also made an appearance, as it taxied down the runway to show off for the audience.

To show off the performance of many of the aircraft and to get the excitement levels elevated a bit, there were several barnstorming demos flown. The most famous, the Delsey Dive, is where the pilot throws a roll of toilet paper overboard and then sees how many times he can cut the quickly falling paper streamer with his propeller. Also, all the airplanes took turns trying to pop helium-filled balloons released by the ground crew. In total, there are more than 70 vintage aircraft in the Aerodrome's collection, along with dozens of engines and artifacts and more than 20 antique automobiles, trucks, motorcycles, and even a French WW I tank.

And the Winners Are...

For the most part, the ORA Jamboree is a great big, enjoyable, low-pressure fun-fly. But during the weekend, the scale guys are judged from the sidelines by the Jamboree's staff, and traditional Jamboree awards are given out to recognize the aircraft that truly stand out. This year, the laser-engraved awards were sponsored by *Model Airplane News*. The winners were:

Award	Contestant	Model
Spirit of Rhinebeck	Sal Calvagna	Sikorsky *Ilya Muromets* bomber
Best in Show	Greg Hahn	Gotha G.IV bomber
Best WW I	Brian Perkins	Bristol Scout
Best Golden Age	Curtis Switzer	Curtiss B-2 Condor
Junior Best in Show	Corbin and Curtis Gay	E-powered foam-board Taube



Greg Hahn's amazing Gotha bomber looks majestic with wind under its wings.

AMA Historic Landmark

It was only fitting that, at the 50th anniversary of the WW I RC Jamboree, the Old Rhinebeck Aerodrome received an impressive award from the Heritage Program of the AMA. Presented by Bob Brown, president of the AMA, and Eric Williams, vice president (District II) of the AMA, the award was given to Michael DiGiacomio, president of the ORA, and contest director Warren Batson. Consisting of two very large cast-bronze placards, the award bestowed the status of National Aeromodeling Historic Landmark to the Aerodrome. It recognizes Cole Palen, who

AMA president Bob Brown (left), Aerodrome president Michael DiGiacomio (center), and contest director Warren Batson (right) were present at the award ceremony granting ORA historic landmark status.

Here is a close-up view of the cast-bronze placards awarded to the ORA.

founded the Aerodrome in 1958 and who also, in 1967, partnered with the Mid-Hudson Radio Control Society and the AMA to create the first annual WW I Jamboree. The very first event of its kind, the Jamboree went on to draw contestants from around the world, helped promote both the ORA and the RC hobby, and at its peak attracted more than 8,000 spectators. The Heritage Program, established by the AMA Executive Council in 2003, is an official list of organizations, businesses, and sites significant in the history of aeromodeling. Since its inception, the award has been given out only five times.

Sal's award-winning Sikorsky *Ilya Muromets* bomber took 16 months to build.

Feeling the Spirit

Of particular note is the Spirit of Rhinebeck award, which is given each year to the one modeler who goes above and beyond with his or her airplane. Each model is closely examined, and its detailing and craftsmanship have to be of the highest caliber. This year, the Spirit of Rhinebeck award went to Sal Calvagna of the Long Island Skyhawks RC club for his amazing 16-foot-span, electric-powered Sikorsky *Ilya Muromets* bomber. Sal spent more than 16 months designing, building, and detailing this flying masterpiece, using drawings and information he received from Russia.

To test-hop his amazing bomber, Sal waited until after the event was officially closed on Friday evening and no one else was flying. And when we say "test-hop," we mean he flew the bomber under perfect control for practically the full length of the Aerodrome's runway. It was the highlight of the day, and his efforts were well deserving of the coveted award.

Greg Hahn teamed up with Dan Landis to fly their 1/3-scale Fokker D.VIIs in close-formation flights.

Mission Accomplished

Another reason to attend this year was the return of vintage competition! The members of the Mid-Hudson Radio Control Society brought back the Mission competition, and this year, 25 pilots entered. Run in conjunction with the non-competition flights, the Mission competition (last flown 20 years ago) started on Friday morning and was flown whenever a contestant was ready to go with a legal airplane. Each flight included a bomb drop, a maximum of three passes to burst a balloon supported 10 feet above the ground, and a final spot landing. The plane of choice turned out to be the old 3-channel Ziroli Taube. There were other aircraft in the .60 two-stroke to .90 four-stroke range, but the majority of the official 161 flights were with Taubes. Points are earned from each part of the flight, and a perfect score is awarded when all the tasks are successfully accomplished on the very first try.

With a perfect score of 900 points, Nick Ziroli Jr. won the Mission event. He flew his 25-year-old Ziroli-designed Taube, powered by a well-broken-in .90 four-stroke engine.

Third-place Mission finisher Dan Landis attaches his golf-ball bomb to his Taube.

Mark Your Calendar

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MISSION RESULTS

Place	Contestant	High Score	Average Score	Model
1	Nick Ziroli Jr.	900	566.667	Taube
2	Tim Haggerty	800	527.941	Taube
3	Dan Landis	700	448.846	Taube

Nick's Taube makes a pass at the target balloon.

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PHOENIX MODEL Spitfire 20–30cc GP/EP ARF

The Royal Air Force's iconic fighter

BY **KLAUS RONGE** PHOTOS BY **PETER HALL**

Renowned for its many victories during the Battle of Britain and in every theater of World War II, the Supermarine Spitfire was the mount of choice of British fighter pilots. It began production before the war and was used well after it ended, with numerous performance enhancements along the way. The Phoenix Model Spitfire is approximately 1/6 scale and has many scale features that capture the elegant design of the original.

The ARF is constructed primarily out of balsa and plywood, and is very well built to take the stresses of a warbird. The camo scheme is expertly done in UltraCote, with some of the insignia already applied. I believe no warbird is complete without retractable landing gear, and the Phoenix Model Spitfire includes a set of CNC-machined mechanical retracts. A molded scale cockpit and pilot figure come installed and painted as well as the canopy. The one-piece wing includes ailerons and scale split flaps. Some of the scale features include exhaust stacks, plastic spinner, decal sheet, and a pair of wing guns. Also included in the kit are a painted cowl, a removable top hatch, wheel fairings, a fuel tank, main and tail wheels, control-linkage hardware, a complete hardware package, and an instruction manual. Mounting hardware for both gas and brushless electric power is provided.

Although the majority of the construction is done for you, it is a WW II warbird and is, therefore, a little more complex to assemble than a typical sport ARF. Modelers who have assembled and flown a few balsa ARFs should be able to easily assemble the model and fly it.

SPECIFICATIONS

MODEL: Spitfire 20-30cc GP/EP ARF
MANUFACTURER: Phoenix Model (phoenixmodel.com)
DISTRIBUTOR: Tower Hobbies (towerhobbies.com)
TYPE: Scale warbird
WINGSPAN: 71 in.
WING AREA: 821 sq. in.
LENGTH: 62 in.
WEIGHT: 13 lb. 6 oz.
WING LOADING: 37.54 oz./sq. ft.
POWER REQ'D: 20-30cc gas engine or 450Kv brushless outrunner motor and 120-160A ESC
RADIO REQ'D: 6+-channel with seven standard-size, high-torque servos, two retract servos, and one throttle servo (gas)
PRICE: $360.00

GEAR USED

RADIO: Futaba 10C transmitter w/ R617FS receiver; seven S9155 servos, two S9001 servos for throttle and choke, two S3170G servos for retracts (futabarc.com); LiFeSource 6.6V 3200mAh 10C receiver battery (lifesourcebatteries.com)
ENGINE: DLE 30cc (dle-engines.com), with LiFeSource 6.6V 3200mAh 10C ignition battery
FUEL: Gasoline/oil mix
PROP: Xoar 18x10 (xoarintl.com)

HIGHLIGHTS

- Excellent scale fidelity
- Retracts included with CNC struts
- Electric- or gas-power options
- Great flying characteristics

UNIQUE FEATURES

The well-illustrated instruction manual contains little text but is more than adequate for assembling the model. Assembly starts with hinging the aileron and flaps. All the control surfaces have the hinge slots cut and ready to accept the included CA hinges. Hint: Install the flap control horn before gluing in the hinges as the horn is difficult to install once hinged. The plastic control horns used on all the flight surfaces are heavy duty and of high quality. I used a pair of RC car-body scissors to cut out the plastic wheel wells prior to gluing them in place. Each wing panel houses an aileron, a flap, and a retract servo hidden under a hatch. The mechanical retracts installed with no difficulty, but make sure that the servo is not stalled at either endpoint. I needed to loosen the three setscrews securing the wheel struts and turn them so that that the main wheels would be in proper alignment. I also added Loctite at the same time. The wing halves are glued together after inserting the aluminum wing tube and held onto the fuselage with nylon bolts.

Fuselage assembly begins with gluing the horizontal stabilizer in place after careful alignment. I needed to lightly sand the fuselage slot to get a good fit. Radio and systems installation is made easier with the large removable top hatch. The sturdy aluminum tailwheel is installed under a removable hatch and actuated via pull-pull cables, as is the rudder. Each elevator half is controlled by individual servos installed in the fuselage. Because I am using a 7-channel receiver, I used a Y-harness to connect the elevator's halves, ailerons, retract, and flap servos. For electric power, the flight batteries are located under the removable hatch, and for gas power, the fuel tank is located there. The throttle servo for the DLE 30cc is mounted to a plywood plate, which is attached above the fuel tank. I added a choke servo, not only as a convenience but also as a means to shut off the engine via the radio. In addition to the DLE 30cc engine, the instructions show the installation of

Above: I installed the radio and ignition switches under the upper removable hatch to keep the external lines clean. **Left:** The powerful DLE 30 engine with its stock muffler is a drop-in fit and provides the Spitfire with spirited performance.

Above: Some of the scale features, such as split flaps, retractable landing gear, and wing guns, can be seen here. **Left:** The shock-absorbing retracts feature CNC-machined struts and seem to be very robust. **Right:** Heavy-duty control horns are supplied on all control surfaces. The rudder and tailwheel are actuated by pull-pull cables.

The Spitfire is prepared for its first mission. A thorough preflight check helps ensure a successful maiden flight.

the DLE 20cc and electric motor. After gluing the two exhaust stacks to the cowl, I trimmed it to fit the engine using a Dremel tool.

I was able to balance the Spitfire at the recommended center of gravity by locating the 3200mAh LiFe ignition battery on the engine box. As a final touch, the high-quality graphics were applied.

IN THE AIR

With the DLE 30 broken in and clear blue skies, it was time to see what the Spitfire could do. The narrow track of the scale landing gear was not a problem, and ground handling was typical of a WW II fighter. Taxiing and the initial takeoff roll required full up-elevator to prevent nosing over; pilots who have some tail-dragger experience should have no difficulty getting the plane off the ground. After takeoff, it was obvious that the smooth running DLE 30 combined with the Xoar 18x10 prop (which I painted black with yellow tips) had more than enough power to keep the Spitfire in the fight.

GENERAL FLIGHT PERFORMANCE

Stability: The plane is very stable at all speeds yet has all the maneuverability of a fighter.

Tracking: I only needed a few clicks of down-elevator to get the Spitfire flying hands-off. Tracking is excellent in straight-and-level flight as well as turns. Rudder is not necessary in the turn, but a little does help.

Aerobatics: The Spitfire performs all the maneuvers the full-size fighter is capable of with ease. I used the recommended high rate settings and found the controls to be well balanced and not touchy. The roll rate is moderate at these settings, and I have since increased the aileron throws slightly. About 3/4 throttle is all that is needed to maintain a scalelike speed, with full power needed only for loops and other aerobatic maneuvers. The Spitfire's repertoire includes all the classic aerobatic maneuvers, such as loops, hammerheads, and half Cuban-8s. Inverted flying is equally easy to perform.

Glide and stall performance: Despite the fairly heavy wing loading and elliptical wings (sometimes prone to tip-stalls), the Spitfire turned out to be very docile and didn't show any signs of the nasty tip-stall. Tight turns at low speeds do result in the onset of a stall, but adding a little power quickly gets the plane flying again.

THE INITIAL TAKEOFF ROLL REQUIRED FULL UP-ELEVATOR. PILOTS WHO HAVE SOME TAIL-DRAGGER EXPERIENCE SHOULD HAVE NO DIFFICULTY GETTING THE PLANE OFF THE GROUND.

The Perfect Warbird Takeoff

If you hang around the flying field long enough or watch the crash videos on the Net, you will have witnessed the dreaded stall/spin on takeoff. The warbird lifts off prematurely and/or assumes a high angle of attack after takeoff and rolls to the left resulting in the sickening thud of the crash. The pilot of the doomed airplane usually proclaims that he had radio failure because he was giving it full up-elevator and right aileron—the exact controls necessary to enter and deepen the stall. All airplanes, but most noticeably WW II tail-draggers, exhibit left-turning tendencies due to engine torque and other factors. Here are a few tips to make your maiden flight of your warbird a success:

- Advance the throttle positively and smoothly. Applying the throttle too slowly or quickly results in a takeoff roll that is difficult to control.
- Anticipate the left-turning tendency, and be ready with the rudder to keep the plane going straight. Also, anticipate how the crosswind will affect the plane. If there is a very strong left crosswind, the plane might not have enough rudder authority to keep it on track. It's better to wait for another day.
- Apply full up-elevator during the initial takeoff roll, easing off the elevator as the plane builds speed. Let the plane run on the mains until sufficient speed is attained and then smoothly apply backpressure to lift off. Climb at a shallow angle until you are sure there is sufficient flying speed.
- Use grass runways, which are much more forgiving than hard-surface runways. Asphalt runways require a quicker reaction time to prevent the plane from getting away from you.
- Make sure that, if the main wheels have adjustments, there is some toe-in to help keep the plane going straight.
- Don't be afraid to abort the takeoff if something doesn't seem right.

PILOT DEBRIEFING

The instruction manual recommended only 20mm of flap throw, which seemed far too little to be effective. I doubled that, which seemed to work well to slow the plane with no noticeable change in trim. With the split flaps and landing gear deployed, the Spitfire slows nicely for landing. A few clicks of power during the approach will keep the plane safely above stall speed with the added drag of the flaps and gear.

BOTTOM LINE

With its many scale features, great flying characteristics, and quick assembly, the Phoenix Model Spitfire is a warbird you'll want to add to your hangar. I find the size to be very convenient; it is large enough to have a nice presence in the air, yet it is easily manageable for transport and storage. Whether you choose gas or electric, you'll have a blast making high-speed passes or slow flybys with the flaps and gear down.

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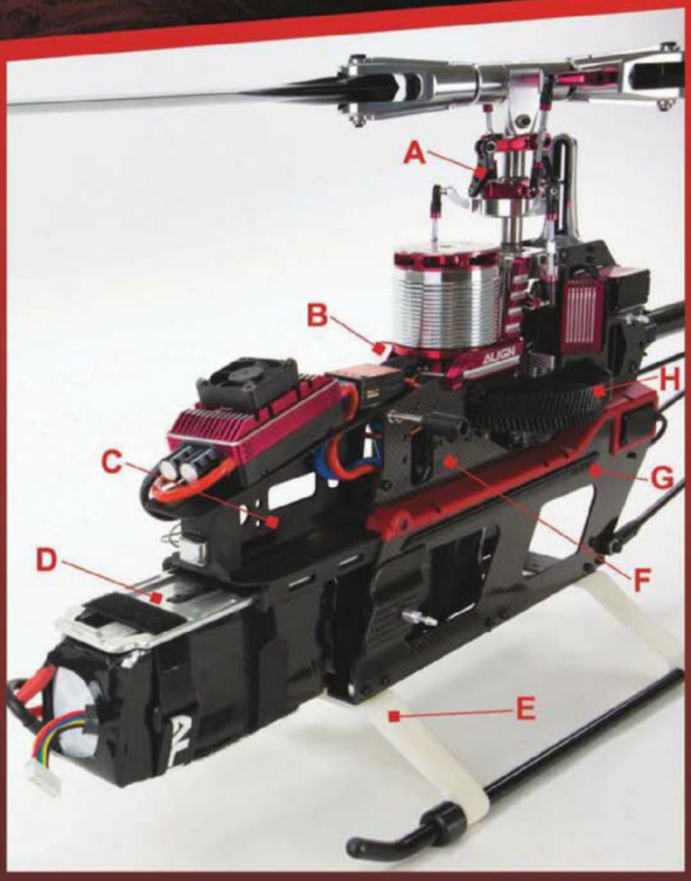

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SPECIFICATION

- Length: 1320mm
- Height: 360mm
- Width: 195mm
- Main Blade Length: 700mm
- Main Rotor Diameter: 1582mm
- Tail Rotor Diameter: 281mm
- Motor Drive Gear:13T
- Main Drive Gear:110T
- Autorotation Tail Drive Gear: 104T
- Tail Drive Gear: 22T
- Drive Gear Ratio: 8.46:1:4.73
- Weight(With Battery): Approx. 5100g

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HOW TO

Make Vinyl Stripes

A METHOD TO WRAP AROUND COMPLEX CURVES

BY **JOHN KAUK**

For a recent project, a Top Flite giant-scale Corsair, I needed to cut vinyl stripes to fit vertically around the rear fuselage. Because of the complex cross-sectional shape—a sharply tapered, narrow top curve that transitions to a round bottom, a simple straight stripe wouldn't work. First, I tried a version of the stripes I copied from a plastic model decal set, which I sent to Callie Graphics (callie-graphics.com) for cutting. Callie did the original graphics for this model for me, and I wanted the stripes to match the other markings. These stripes were better but not quite right. When I tried to bend them over the sharp upper curve, they wrinkled and wouldn't stretch well into place.

YOU'LL NEED

In addition to the laser level (right), the tools necessary for this project include a cutting mat, French curves, a straightedge, a hobby knife with a new sharp blade, a fine marking pen, and a tube of restickable glue. These two stripes show the curve necessary to fit the rounded bottom of the Corsair fuselage.

IT'S A GOOD WAY TO GET GREAT RESULTS USING TOOLS YOU PROBABLY ALREADY HAVE.

The next option was to cut a set myself. I'd gotten some spare vinyl from Callie when I ordered the stripes, so matching material wasn't a problem. My friend Jim Ryan, a *Model Airplane News* contributor, suggested a technique using a laser level to paint straight lines over the fuselage to get a perfect template for the stripes, so that's what I did.

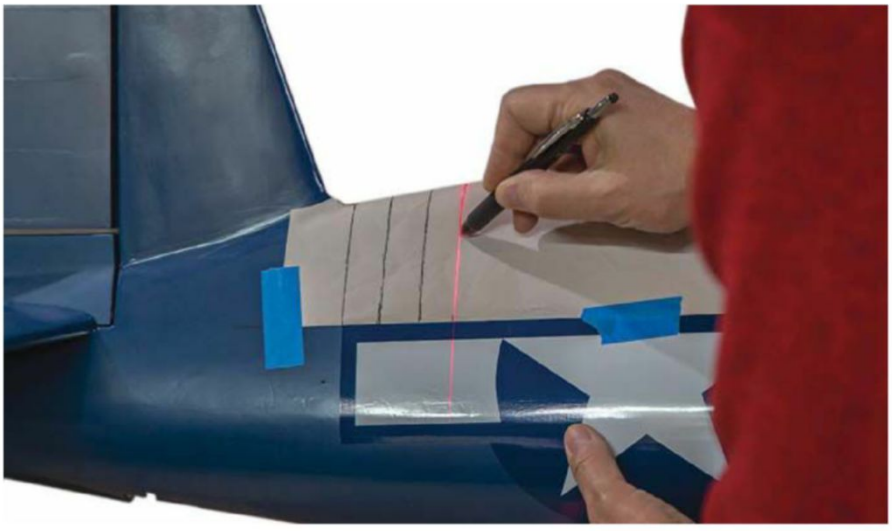
The first step is to fit some paper tightly onto the area of the fuselage where the stripes will go. For this plane, that's the rear fuselage just in front of the vertical fin. I taped the pattern paper in place and trimmed it to clear the bars on the U.S. insignia on both sides. I also marked where the vertical lines would go so that I'd have a reference for setting the laser for each line.

Next, I needed to set the fuselage in place with a level reference. Because I wanted the stripes to be perpendicular to the Stars and Bars insignia, I used the laser to level the top line of the bars using shims under the foam stand holding the fuselage. I then mounted the laser so that it pointed straight down above the area covered by the template paper, moving it into position for the rearmost line of the stripes. For this, I used a spare light-stand boom, but a ceiling rafter or other vertical surface would serve just as well. With the laser centered over the peak of the fuselage, it was a simple matter to trace over the line with a fine marker. After marking that line on both sides of the fuselage, I moved the laser to line up on the next mark and repeated the process for the three remaining lines.

Removing the template showed a set of four rough curves, with a much sharper bend in them than I expected. I used a pair of French curves to clean up the roughly sketched lines, then cut out a template for the two stripes. It was a simple matter to attach the templates to the vinyl with a restickable adhesive stick and cut the stripes out. I dry-fit them in place to check, and it worked! The stripes fit quite well. I sprayed the fuselage with window-cleaning fluid so that the stripes wouldn't adhere immediately, giving me time to position them properly before squeezing out the liquid using paper towels.

Remember this technique the next time you're thinking of doing markings or decorations for a plane with a complex fuselage shape. It's a good way to get great results using tools you probably already have in the garage or shop.

In this photo, the laser-level reference is set to the top of the insignia bars. Template paper is tightly fitted to the fuselage, and the stripes' measurements have been marked on the paper.



Here, the author is tracing over the laser line, which is held vertically directly overhead and lined up on one of the measured marks on the template paper. The rough sketch lines are cleaned up later using French curves and a straightedge before cutting.

The results, while not perfect, are pretty good for a first-time effort. A bit more time spent on cleaning up the templates would have improved the stripes, but the author is happy with them as they are.

FMS 1100mm PC-21 PNP

This "21st-century trainer" delivers scale performance

TEXT & PHOTOS BY **ANDREW GRIFFITH**

FMS has been producing models that are often unique in either design or color scheme, and its new Pilatus PC-21 is no exception. Featuring a 43.3-inch wingspan, the PC-21 is a sharp-looking and unusual subject modeled in a convenient size. The high degree of prefabrication means that much of the work required to get into the air is already completed for you.

The PC-21 is constructed of high-ratio and low-density EPO 52 foam. EPO 52 is quite strong but weighs 15 percent less than high-density foam. The model comes factory painted in a striking bright red Pilatus factory color scheme that uses an environmentally friendly water-based paint. The sleek lines of the fuselage, the swept-back wings, and the mean-looking 5-blade propeller combine to make the PC-21 look a bit like a Ferrari with wings—poised to go fast!

New reviewer Andrew Griffith with the PC-21.

SPECIFICATIONS

MODEL: 1100mm Pilatus PC-21 PNP
MANUFACTURER: FMS (fmsmodel.com)
DISTRIBUTOR: Force RC (forcerc.com)
TYPE: Foam sport-scale (receiver-ready)
WINGSPAN: 43.3 in.
WING AREA: 330 sq. in.
LENGTH: 48.6 in.
WEIGHT: 3 lb. 10 oz.
WING LOADING: 25.3 oz./sq. ft.
RADIO REQ'D: 6-channel
PRICE: $199.99

GEAR USED

RADIO: Spektrum DX18G2 w/ AR6210 receiver (spektrumrc.com); seven 9g digital servos (installed)
MOTOR: 750Kv brushless motor and 40-amp speed control with integrated BEC (installed)
BATTERY: E-flite 4S 3200mAh 30C (e-fliterc.com)
PROP: Scale 5-blade (included)

HIGHLIGHTS

- Extremely detailed scale appearance
- Plenty of room to locate the battery for proper center of gravity
- Includes both flaps and retractable landing gear
- Striking and easy-to-see red scheme with white trim

UNIQUE FEATURES

A detailed inspection of the PC-21 showed that its claim to scale accuracy was not overstated. The PC-21 has numerous panel lines and hatches molded in, and even the catch pin for the hatch looks like one of the small radio and navigation antennae that dot the fuselage. The battery hatch itself comprises the two-place cockpit and includes a pilot bust in the front seat as well as fairly detailed printed instrument panels and ejection seats. The pilot even proudly sports a 1980s' *Magnum, P.I.* mustache!

The FMS PC-21 requires a 6-channel radio and includes both flaps and retractable landing gear as well as the primary flight controls. The ailerons, flaps, and rudder/nose wheel each use a Y-harness that is connected at the factory. The retractable landing gear are electrically actuated and come with a three-way harness.

The landing-gear legs are quite detailed, and the front landing-gear strut even has a splash fender and faux landing lights. The front landing-gear strut has operating doors that are spring-loaded open and are pulled closed when the gear is retracted. The main gear has the landing-gear doors attached to the struts exactly like the full-scale version. If I were

FULL POWER RESULTED IN SPEEDS THAT APPEARED TO BE IN THE 70–75MPH RANGE—NOT BLAZING FAST BUT QUITE FUN.

to have a wish, I'd ask for the landing lights to be equipped with functional LEDs; then the already great-looking model would really pop! I put a lot of flights on the PC-21 over the course of two weeks and never had any issues with the electric landing gear—indeed, half my club must have flown it on Model Aviation Day.

All of the control surfaces come prehinged with molded foam hinges, and all of the pushrods and hardware are already installed. The only control surface that needs to be connected is the elevator pushrod when the horizontal stabilizers are installed. On the subject of the horizontal stabilizers, they slide together over a carbon-fiber joiner rod and are held in place with two screws on each side. The elevator joiner is square shaped, ensuring perfect alignment of the elevator halves.

One of the neatest things about this model, though, is the business end. A 40-amp speed control provides power to a 750Kv brushless motor, which swings a very scalelike 5-blade propeller. Everyone that saw the PC-21 on the bench said something about the cool-looking propeller and the overall look of the plane. I knew that if it flew as good as it looked that FMS was onto something!

IN THE AIR

We are fortunate to have both paved and grass runways at my club. While flight operations from a paved or geotextile-type runway would be preferred, the PC-21 will fly well off of short grass. Longer grass may be troublesome between the gear doors and the relatively small wheels.

Takeoffs with the PC-21 are quite easy: Smoothly advance the power and the PC-21 will be airborne in less than 50 feet of paved runway. Taking off with the flaps at their first increment results in a slightly shorter takeoff roll, but they aren't required by any means.

Full power resulted in speeds that appeared to be in the 70—75mph range—not blazing fast but quite fun. I suspect speed freaks will want to tinker with the power setup, but everyone I let fly it thought that it was entertaining enough stock.

The flaps help slow the PC-21 down for nose-high main-wheel landings but, when fully deployed, cause some ballooning. I mixed some down-elevator and slowed the flap servos to three seconds for a full sweep.

One of the neatest features of the model is the 5-blade prop, which duplicates the composite 5-blade prop on the full scale. Also, the exhausts for the turboprop engine and even the splash fender on the front landing gear are reproduced on this finely detailed model.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With the flaps and landing gear extended, the PC-21 requires a bit of power to overcome the additional drag. Landings are easy because of the low stall speed, and the PC-21 will settle on the runway and stop after a very short rollout.

Stability: In the air, the PC-21 was quite stable and maintained that even when the wind started to pick up. The ultimate compliment was given to the PC-21 when I landed and was asked what gyro I was using! (None.)

Tracking: Once airborne, the PC-21 tracked very nicely indeed. Other than a few clicks of up-elevator, the PC-21 was flying around hands off. Lines were very smooth, and inverted was accomplished with a bit of down-elevator input.

Aerobatics: Aerobatics were about what I expected from this type of aircraft. The PC-21 tracked well in loops, and while vertical wasn't unlimited, it was quite good. Rolls were nearly axial and fairly quick in high rate. You can wind up a spin pretty good with a little power, and recovery consisted of relaxing the controls to neutral and letting it settle.

Glide and stall performance: Stall speed was slower than I expected, even without the flaps deployed. Once stalled, the PC-21 dropped a wing, but the speed at which it occurred was so slow that the controls were completely ineffective.

PILOT DEBRIEFING

What a joy to fly! The PC-21 does a little bit of everything, from sport flying to mild aerobatics. It's very stable and fun at full throttle but slows down nicely for scalelike landings, and the flaps are very effective. Everyone who saw this plane fly asked how much it cost and where to purchase it!

BOTTOM LINE

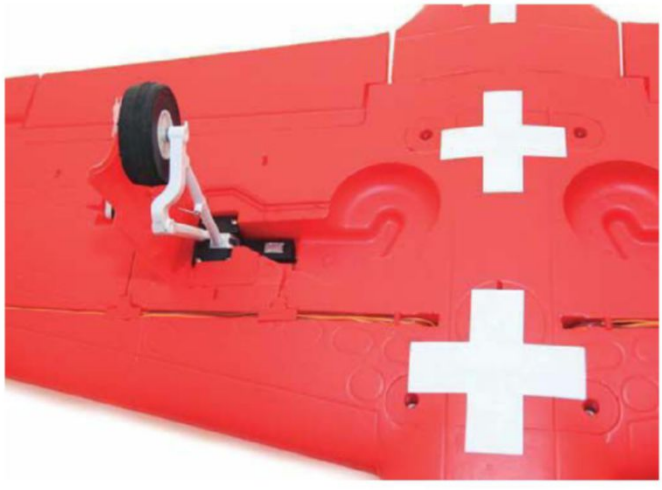
The PC-21 takes about 15 minutes to assemble and another 30 or so to complete the wiring and program the radio. It's extremely easy to build and does so without the need for any modifications or alterations. There's no glue; only nine M2 screws are needed to install, and a prop nut has to be tightened.

While the speed isn't blistering, the PC-21 is a lot of fun to fly with the stock setup. Nearly everyone who saw it asked about it or commented on it. Five- to seven-minute flights are possible, and it will tolerate larger batteries for more flight time, as we flew up to 4200mAh packs with no loss of performance.

The 21-Century Trainer

Dubbed the "21st-century trainer" by Switzerland aircraft manufacturer Pilatus Aircraft, the PC-21 is a single-engine, tandem-cockpit, advanced military trainer powered by a 1600hp turboprop engine swinging a unique 5-blade carbon-graphite propeller. Excellent flight performance and an advanced avionics suite allow the PC-21 to fill a variety of flight- and mission-training roles. Pilatus Aircraft was founded in 1939 and is currently the world-market leader in the manufacture and sale of single-engine turboprop aircraft. It is the only Swiss company that develops and produces private and training aircraft.

The PC-21 requires a 6-channel radio system and a 4S LiPo and charger. I used an AR6210 Spektrum receiver and E-flite 4S 3200mAh battery. The PC-21 flew fine with packs up to 4200mAh, which also extended the flight time to nearly seven minutes.



The PC-21 includes electric retracts with very detailed struts and gear doors.

Getting Started in Drones

From camera platforms to racers, we've got you covered BY **JOHN REID**

Now that you've seen drones everywhere and they seem to be invading every flying field across the country, you made the decision to pick one up and start flying it—just to see what all the excitement is about. But unlike planes, these are a different kind of beast, and you might not be sure exactly where to start. This is why you're reading this article: in the hope of obtaining the information you need about the latest technology in the drone world. I will try to help you out in that search and also offer up tips and tricks to make drone flying easier. But first things first—let's talk about how to get started.

Where Do I Start?

In some respects, flying drones is similar to flying airplanes: They use a familiar transmitter, and control inputs are relatively similar. But they are different, and their controls will take a bit of thumb retraining. If, however, you have flown helicopters before, then you are ahead of the game; drone flight will be very similar to helicopter flight. So where is the best place to start? The same place you did when learning to fly airplanes: on a flight simulator.

Almost all of the flight simulators that are on the market today have some type of multirotor quadcopter built into the programming. Many people who have been flying for some time will already have some type of flight simulator. If your simulator does not have a quadcopter, it might require software updates to the programming or purchasing a new add-on. Once you have that bad boy installed, start flying around in your simulated environment. While this might not react exactly like a multirotor in the real world, it will definitely be close enough to get your thumbs acclimated to flying a multirotor aircraft. After mastering this virtual world of flying, the next step will be to purchase your first multirotor.

PHOTO BY CARL HYNDMAN


MTB

Real-World Experience

Start out small. There are literally thousands of mini multirotors available from just as many manufacturers, but I would recommend purchasing from a manufacturer that you know or like. These include many of the same people from whom you buy your fixed-wing aircraft, and they will most likely have a larger multirotor platform that you can eventually move up to. The two big advantages of starting out with a small multirotor is that, first, it is inexpensive and, second, many are somewhat crash resistant—plus they are great fun to fly.

Starting out with a smaller drone like the Dromida Ominus XL (below) will soon have you moving up to larger ones. Practicing with a flight simulator will accelerate your learning curve.

Indoors Training

One of the beauties of having a mini multirotor is that you can train indoors. The downside to that is there are more obstacles inside, and you will most likely be crashing into a number of things in your environment. But because the mini multirotor has so little inertia going into stuff, it will most likely survive a number of crashes. Your job as the pilot is to make sure that you don't crash into anything that is valuable inside your house. So a quick survey of your flight room to remove valuable items might be in order.

It won't take long to master flying around the house, so the next logical step is to increase your flying skills by making it more difficult to fly around the house. Do this by creating an obstacle course. Solid objects, such as the coffee and dining-room table, are fair game. First, try flying around them with control, then under them; after that, make up a course moving through and around many different objects to make it fun and challenging.

Practice forward flight—slowly—then boost up your speed as you maneuver around the various obstacles. Once you're feeling really cocky, fly the same obstacles while traveling backward or sideways.

GET DRONED

VEKTOR 280

FPV RACING DRONE

FEATURES

- Fully-Built Carbon Fiber Frame
- CC3D Atom Open Pilot Flight Controller
- Powerful 2204/2150KV Brushless Motors
- 20 Amp ESC's w/SimonK
- Multifunction LED Lighting
- Drone Finder Function
- Paintable Clear Canopy (Shown Here Customized)
- 9 – 12 Minute Flight Times
- Weight: 348 grams / 12.28 ounces

FPV SYSTEM

- 400K Pixel 135° Field-of-View Video Camera
- 600mw 32-Channel 5.8GHz Video Transmitter*

RR RECEIVER READY

Join the quad-racing ranks with our swift and fearless Vektor 280! Designed with a resilient, high quality carbon fiber frame with 3mm arms, this completely assembled speedster delivers adrenaline-pumping FPV action. Simply grab a 6-channel radio system, 3~4S LiPo battery, 5.8GHz video receiver and goggles and shred through the air. Get droned with the Vektor 280 – everyone's doing it!

* FPV video transmitters with an output power greater than 25mW require a HAM license to operate legally in the USA.

HITEC

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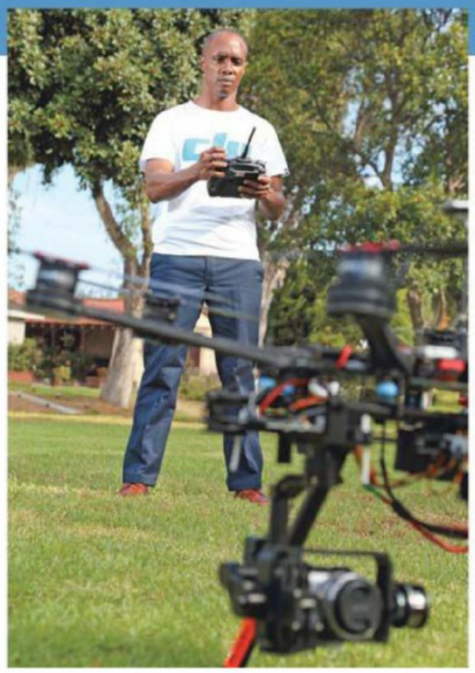
Moving On Up

Once you've mastered indoor flight and maneuvering with the mini multirotor in any direction, it is time to move up to the larger drones. You will realize three things rather quickly about larger drones. The first is that they come with a higher price tag, and your available cash will determine the size you finally settle on. One good standard to use: Don't buy anything you can't afford to crash. A downed multirotor will make you cry, but it shouldn't create a financial hardship.

The second thing is that the midsize to large quads will have some type of stabilization built in; as a result, flight stability will be much improved and make it easier for you to control your drone. Many drones will have two to three different flight-stabilization modes that you can select from. I recommend starting out using the most stable flight mode; as your skills and confidence advance, move to the mode that gives more flying control to you, the pilot (i.e., less stabilization). You might eventually settle on flying always in the mode that has the maximum stability (such as GPS). You will want to learn how to fly without it, however, in case you are put in a situation where stabilization becomes disabled. If that should ever happen, having the ability and confidence to fly without it could be a real lifesaver.

Because of the distance you can achieve outside, orientation will be an issue at some point. Some orientation modes will allow you to fly the aircraft with the nose pointing in any direction but still maintain the control of the aircraft to your location. Whatever orientation mode you start with, my recommendation is to stay with that at least in the beginning. Once you've mastered that one, then move on to a different orientation mode and master that one.



First Flight

Finally, the big day comes to fly your larger multirotor and you feel good. All the prep work with the simulator and mini multirotor have paid off, your confidence is up, your knees are still a little shaky, but you are ready. You still want to approach things slowly. Start by flying over some flat land with few or no obstacles; this will make it easy to land if necessary. You absolutely do not want the first flight to be in a heavily forested area or out over the water; this will just add to your first-flight jitters. If possible, have an experienced multirotor pilot next to you; you will be surprised how much this will help boost your confidence for your first flight. That person can also serve as a spotter, which you should have on every flight anyway; a copilot, if any problems should arise; and a savior, if you get totally confused. Once you master flying over flat land, then you can choose how complicated you want the terrain to be while flying your multirotor.

Let Go of the Sticks

Many midsize to large multirotor aircraft will have some type of GPS assist stabilization. What this means is that, when you let go of the control sticks, the multirotor will stop in that three-dimensional space and stay there waiting for your next command. Letting go of the sticks will be the best thing you can do when you get disoriented during the flight; this will let the multirotor level out and stabilize. In most cases, this will save your multirotor 99 percent of the time. Simply put, if you are in trouble, let go of the sticks! Let the multirotor level out and then slowly move the gimbals to see which direction it goes. Once you've figured out the orientation of the bird, then start flying it back toward you. That wasted 20-30 seconds of battery life while the multirotor hovers out there will be one of the best time investments you will ever make.

TWO DIRECTIONS

Now that you know how to fly drones, the next step is to decide what you want to do with your drone. There are two basic roads to travel: using drones as a camera platform to create some stunning aerial photos/videos or getting addicted to the adrenaline rush that is first-person-view (FPV) racing. For most drone pilots, it will be a combination of both. Learning to fly a drone for camera use will require some smooth- and slow-flying skills, coupled with working with a partner who will be operating the camera and gimbal. Drone racing requires nimble stick control and all-out snap decisions to make it through the course. Which direction you choose to go is strictly a personal choice, which will be influenced by what you enjoy doing and how you like to fly. For this decision, I cannot help you. But if you read on, I can give you some recommendations as to some of our editors' picks on the best camera and racing drones.

BEST FIRST RACING DRONES

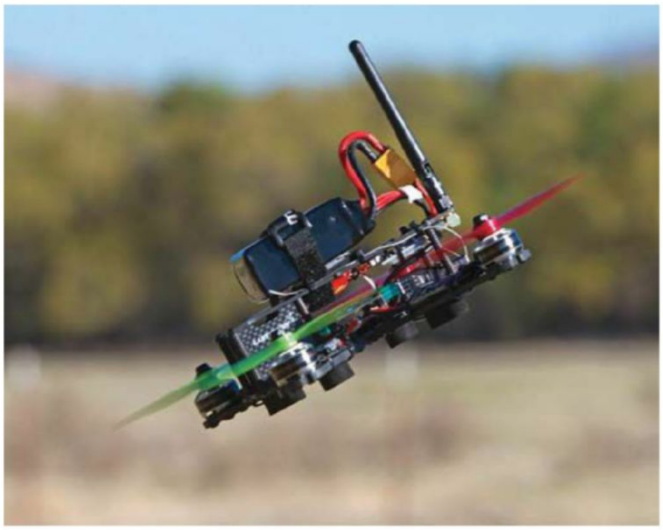
One of the fastest growing aspects of drones is racing, where pilots use FPV to see a real-time image transmitted to them from a camera on the front of the quad to fly a drone around a racecourse. This give the pilots the feeling of actually traveling in the quads as they race against each other and through obstacles. Let's check out which flight modes and video frequencies work best for drone racing.

Hitec QuadRacer 280

This little drone is designed for the new pilot who wants to get into FPV drone racing but doesn't want to spend a lot of time on construction. Out of the box, this is a very stable flying bird that is easy for any pilot to control. It comes with everything you need to get into the air quickly. The first thing to do right out of the gate is to start charging the included 3S 2000mAh battery, along with the included 4.3-inch LCD video monitor. Then it's easy to attach the props and the video antenna. Connect the monitor and install the included AA batteries into the supplied transmitter and you're ready to race! This quad also comes with a durable clear canopy, which lets you customize your racer to suit your own personal style. The QuadRacer 280 offers high and low rates as well as switches for mild or fast responsiveness. We like the fact that it's ready to fly and doesn't require any flight-controller programming. **$399.99; hitecrcd.com**

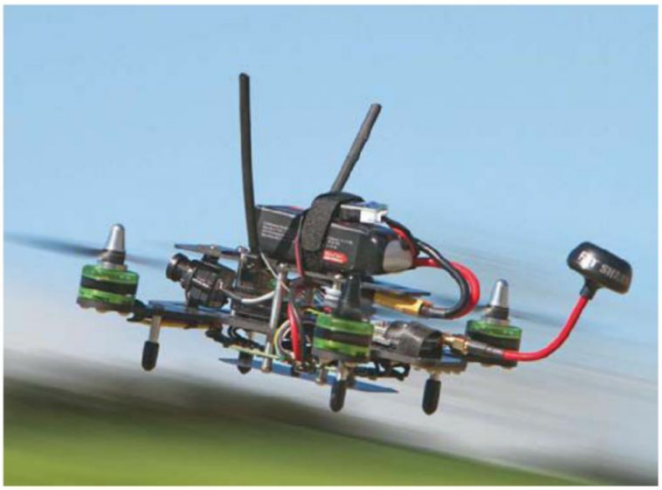
Blade Mach 25 and Teleporter Headset Bundle

Blade's first venture into the world of FPV racing, the Mach 25 FPV Racer looks like it means business. Easy to fly and enjoyable for everyone, this multirotor comes out of the box completely assembled and ready to bind with your Spektrum radio. There is just enough room to get the bind plug into the controller to perform the binding operation without having to remove anything. The battery is mounted in a recess located on the underside of the body using Velcro fastener material. The small 25mW micro FPV camera system includes a video transmitter, and it works rather well when flying alone. The Lexan frame does move around a bit while flying, but overall, the setup works quite well. And because of the canted motor mounts, landings are a bit easier. To get started, you will want to get at least 2 to 3 feet high right away before testing things out. The Mach 25's stabilization is very good, and it wants to get up to speed right away. It can quickly get moving if you are not careful. Control response is really good in the High-Bank-Angle mode, and you could easily race in this mode. But if you're looking for really quick and snappy flying, then the Agility mode is what you want. You'll have a blast scooting around the field. Throw in a few obstacles and another racer and you will be totally hooked on FPV racing. **$399.99; bladehelis.com**



Lumenier QAV-R 5-inch

This carbon-fiber frame machine is designed for the advanced racer who wants a fast and agile bird. It comes with all the frame parts and bolts and the Lumenier 4Power distribution board. Pilots will have to add their own camera, video transmitter, motors, speed controls, flight controller, battery, and receiver. We found assembly and parts fit to be excellent, and all the boards were easy to solder to. The quad features a thicker 2mm top plate and improved removable center X-arm design. This increases the frame strength and also allows the pilot to make a quick arm change during a race if needed. Some nice touches to this quad are the grommet-holding method for the heavy pigtail, and the cutout and mounting design for integrating the video transmitter into the frame, which works perfectly with the Lumenier TX5G2R Mini 200mW transmitter we used. By building to the manufacturer's recommendation, the QAV-R had no trouble keeping up with our local racers and easily pulled away from a few. Its power and performance are outstanding. After a few cartwheel landings, we confirm that this frame is extremely durable and well designed. **$114.99 (frame only); lumenier.com**



Quanum Outlaw 180

The Outlaw 180 is the latest addition to the Quanum Outlaw Racing Series. This little drone comes almost ready to fly and features a full carbon-fiber frame. It is completely built and ready to plug into your receiver, giving you a great pro-level racer right out of the box. The only items needed to get it off the ground are a battery, transmitter, and receiver. The quad comes prebuilt with four 20-amp Afro Race Spec speed controls and four Multistar 2204 2300Kv brushless motors all tied up on a single board with a CC3D flight controller. A small instruction manual gives you the full rundown on programming the flight controller, which uses OpenPilot. This sets you up with a stable, easy-to-fly setting to get you started. The Outlaw doesn't come with any FPV gear, but FPV racing is exactly what it is built for. A camera-mount bracket is attached to the front, and the flight controller is attached separately under the frame, leaving plenty of space in the middle to accommodate your camera, receiver, and FPV transmitter. The airframe comes standard with 5-inch props. The basic settings that the manual recommends make the Outlaw 180 very stable and easy to fly. If this is your first FPV racer, we definitely recommend starting with these settings. **$167.25; hobbyking.com**

Rise RXD250

Made out of carbon-fiber and foam, the Rise RXD250 comes assembled and ready to accept your receiver and FPV equipment. A 250-size racer, it comes completely built with just about everything to get airborne. All you need is a receiver and battery. The flight controller, motors, and speed controls are all securely mounted and ready to go. LEDs on the bottom help with orientation, and there is even a power plug for your FPV transmitter, which has been soldered in place. All the key components are surrounded by foam, plastic, or carbon fiber, so there isn't much risk of damaging anything expensive. The landing gear is strong, but it has plenty of flex, so it won't just break off; it does a nice job of protecting your battery. The RXD250 can be flown with or without FPV gear, and we were impressed by how well it performed. Taking off with the FPV gear obviously required a little more throttle, which was to be expected. Once in the air, it was pretty nimble with both setups. Even in Stability mode, it had a nice response and reacted quickly to our inputs. It's easy to toss around but still holds its line well. For a drone that is built to withstand more crashes and hits, we're impressed overall with how well this 250 handled. **$199.99; explore-rise.com**

Best Flight Mode for Racing

Even basic drones will have several flight modes to choose from. Manufacturers might call them by different names, but their functions are pretty much the same. There isn't a perfect all-around flight mode, so the one that you choose depends on what you plan to do. For beginners, Stability mode is the way to go. The gyro will do its best to maintain a steady attitude and altitude (if equipped with a barometric sensor). At the other extreme, Manual or Acro mode is the least intrusive mode. This is best left to more advanced pilots because you need to be on the sticks at all times, but it will give you the most flowing feel when flying. Some models have attitude modes that will let you program tilt limits, allowing you to have some freedom of movement without letting things get too out of hand. Most experienced drone racers do fly in Manual mode so that they can have complete control.

Using the right mode will make it easy to fly with your connection from the camera mounted on the quad (below) to your goggles (above).

Video Frequencies

There are four FPV video frequencies to choose from:

5.8GHz. This is the most common FPV frequency. If the gear is FCC Part 15 certified, it does not require any licensing (most small ready-to-fly drones at your local hobby shop fall into this category). This frequency has the most choice in channels and uses the smallest antenna. It does, however, have the poorest signal penetration and range.

2.3GHz/2.4GHz. This is a popular frequency for intermediate to long-range setups. It does much better at passing through solid objects, but it prevents the use of a 2.4GHz radio system, so many use the classic 72MHz radios.

1.3GHz. This frequency is very popular when paired with long-range-system radios. Antenna size limits its use on smaller models.

900MHz. Although this frequency seems as if it would be the best choice for those wanting to expand their horizons, it is very close to cell-phone frequencies, so it has a good chance of picking up interference.

BEST FIRST CAMERA DRONES

Cameras and drones are a perfect match, giving videographers and photographers a camera angle they didn't have before; we've selected a few of what we think are the best camera drones for beginners. But before you can produce great-looking shots, you first need to learn the basic flying skills required to create those great images. After you've mastered those, you can perfect your flying to create specific camera moves used on many feature films; we've highlighted two of the most common aerial techniques.

DJI Phantom 4

As with its predecessor, the DJI Phantom 4 is mostly a hollow plastic shell, with highly optimized electronics at its core and a fully integrated camera system. It comes preassembled and, after a summary firmware update and system check, will fly right out of the box. Anybody could fly the Phantom 4 with ease, yet it is intended for intermediate to professional pilots. The basic package comes with a radio, a single battery, a charger, two sets of propellers, a 16GB micro SD memory card, and accessories. DJI also sells a premium kit with two extra batteries and a backpack. We must also mention the included lens cap/gimbal holder clip, which is both useful and practical, contrary to the one that came with previous iterations of the Phantom. It comes in a durable, compact, reusable, stiff foam case with a handle and a latch that serves both as product packaging and as a practical way of carrying your drone around. It's large enough to carry the aircraft with three batteries, the radio, and a few spare propellers and accessories. You will need an Android or Apple phone or tablet to display the video (FPV) with on-screen display. **$1,399.00 (basic); $2,066.00 (premium with two extra batteries & backpack); dji.com**

Dromida XL 370

This large Dromida has better flight stability than its smaller counterparts, but it is still a lot of fun to fly. It comes with a 1080p video and photo camera installed, which will store all of those great images on a 4GB memory card. The Dromida XL comes with everything you need to get it in the air, including an extra set of blades. The only requirement is that you need an Apple or Android device to download the DroneView app. The three-axis gyro with three accelerometers allow for smooth and stable flight. Programming features include auto takeoff and self-landing with a push of a button. Automatic altitude hold allows for easy hovering, and the bright LED light makes it easy to see the Dromida XL 370. It comes in four different colors to make flying with your buddies easy. **$249.99 (1080p camera RTF), dromida.com**

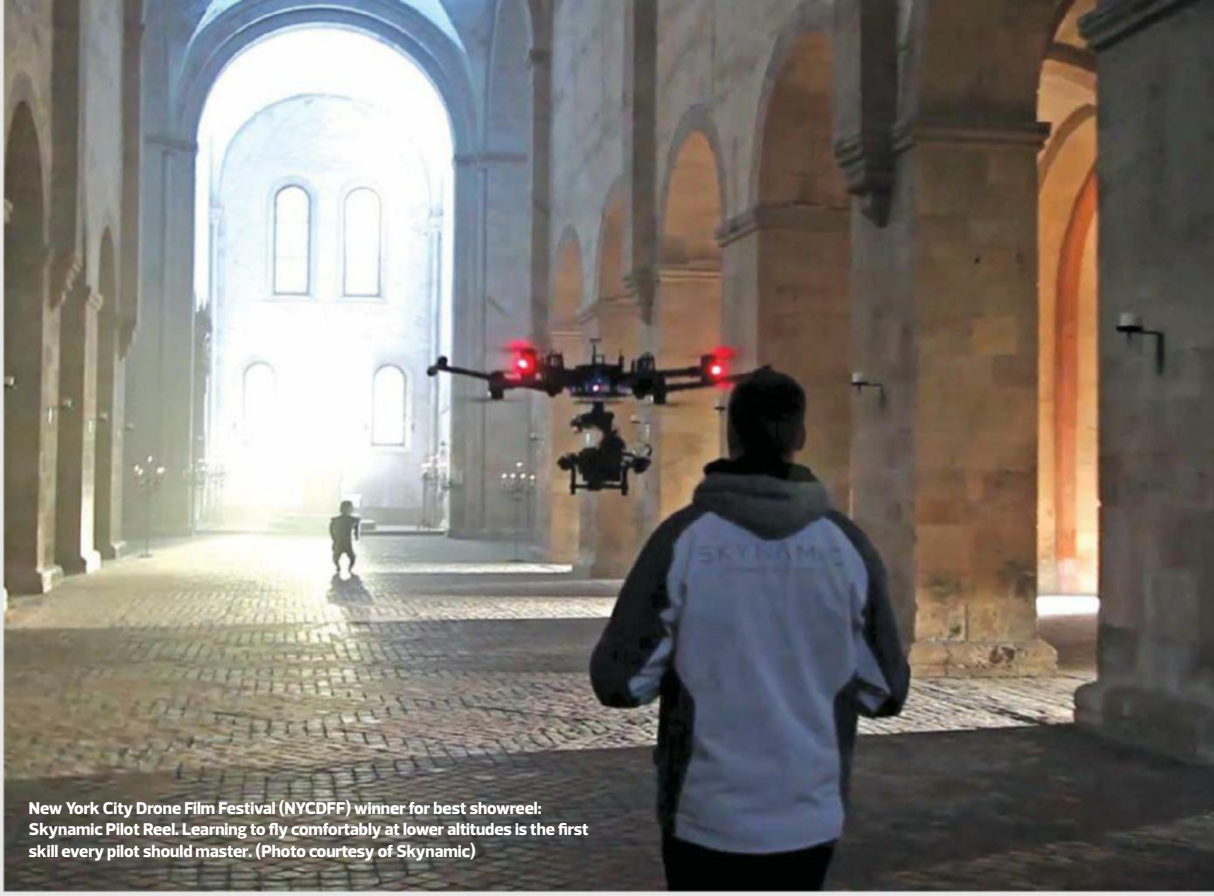
Traxxas Aton+

This all-in-one aerial video/camera package with three solid flight modes is ideal for pilots of all levels. Because everything you need is included, this is an aircraft that you can buy and take right to your flying site! The Aton will arrive in Film mode for smooth, stable flight, so you can concentrate on getting the aerial shot you want. When you exit a turn or stop abruptly from lateral movement, the quad will slowly return to a hover without jerking to ensure stabilized footage. Engage Sport mode and you can now fly faster, perform higher banked turns, and do flips. You can also use the higher speed to film faster-moving subjects. In Expert mode, the Aton will do almost anything but fly inverted, and it's impressive when it rips by at full speed. When you fly upward a bit, hit the trick button and see the rotations the Aton can accomplish. Don't worry about pushing the aerobatic envelope too hard; the airbrakes do a great job at settling the quad back down to a hover from your high-speed antics. The included "batwing" 2.4GHz transmitter has a small digital screen, which gives you info such as flight-mode status, throttle level, transmitter-battery level, and flight-battery level. The included flight pack with the Aton+ model is a 3-cell 5000mAh LiPo. The model is equipped with a Traxxas High-Current Connector. Without a camera, you can expect up to 20-minute flights; with a GoPro Hero4 you can expect up to 15-minute flights. **$419.99; traxxas.com**

Yuneec Typhoon H

Yuneec's latest release, the Typhoon H, requires minimal assembly time, so you can get in the air within minutes of opening the box. It comes with everything needed, including the CGO3+ camera that comes mounted on a three-axis, antivibration gimbal. It provides stable 4K resolution video and has a no-distortion lens. It can produce full HD 1080p with slow motion and also has a 12-megapixel still camera onboard, all of which can be operated from the ST16 controller. All the camera's settings can be adjusted and controlled while in flight, and the camera offers a 360-degree view once the legs are retracted. Takeoffs and landings can be done automatically, but we found manual operation to be just as smooth. While we would not recommend that a beginner start out with this particular model, it would be easy to learn how to fly the Typhoon H. It has a maximum flight speed of 22mph, but while filming, we preferred to shoot video at slower speeds (closer to 13mph). A faster speed, however, is perfect for following a quick-moving subject, and we could keep the objects in the frame for longer periods of time. **$1,299.00; yuneec.com**

CAMERA MOVES



New York City Drone Film Festival (NYCDFF) winner for best showreel: Skynamic Pilot Reel. Learning to fly comfortably at lower altitudes is the first skill every pilot should master. (Photo courtesy of Skynamic)

These two easy drone moves will give your video a professional look:

Flying close to the ground

The first drone-flying move that you will need to practice is learning to fly close to the ground comfortably and smoothly. We're not saying that you should be knocking dew off the wet grass with the camera lens as you fly by, but you do want to have the ability to scoot by your subject at a low angle. Practice so that you can easily fly in any direction low to the ground: forward, backward, and side to side. Most of these types of shots will be from waist to eye level. A good maneuver to practice is flying horizontal figure-8s, first away from you and then back, then from side to side. By flying close to the ground, you can create really long versions of a dolly movement, and then by lifting up the drone from close to the ground, you can create a crane shot that offers unlimited upward movement. A separate upward or downward camera movement can also be incorporated into the low-flight shot.

The fly-through

A fly-through shot is a camera-movement technique created by flying the drone toward your subject and then passing right over it as you continue on your flight. It can be done in a variety of ways: You can fly toward and pass by an oncoming subject, you can fly and overtake a subject traveling in the same direction, or you can fly and overtake a subject going at a different angle from the multirotor. Instead of flying over your subject, you can also pass on either side (after learning how to fly low comfortably). In addition, you can fly the drone toward the subject at a different angle before overtaking it, while changing course so that the aircraft is traveling in the same direction as your subject. This lets the audience know where the subject is heading. Finally, a fly-through can also slow down as you approach your subject, travel at the same speed for a period of time, and finally pass over it.

NYCDFF winner, Showreel, Skynamic Pilot Reel. The fly-through maneuver can be done with a static or moving subject, such as this powerboat. (Photo courtesy of Skynamic)

PRECISION AEROBATICS XR-61

Float like a butterfly and throw down 3D

BY **MIKE GANTT** PHOTOS BY **JOHN REID**

Perhaps combining the feel of a large aircraft in a smaller package is what Precision Aerobatics is all about, and its new XR-61 is an ARF that has been produced to fill the void so many have been asking for. While Precision Aerobatics has plenty of experience with large-scale models, it seems to focus on airplanes in the 4- to 5-foot size. The saying "do one thing and do it well" rings a bell, and if you've ever seen one of Precision Aerobatics' aircraft, then you know just how well they are crafted. Construction consists of select balsa and plywood, which has been engineered with carbon-fiber additions in all the right areas, allowing for the lightest possible airframe. Bigger airframe feel—check. Lighter-weight airframe—check. But what about power? We 3D fans like to have air blowing over the airplane's huge control surfaces for immediate and exaggerated flight responses. The designer not only delivered an incredibly large empennage and wing area but also allowed for a perfect powerplant to complement this plane. An efficient system, which the company calls "iPAs" (integrated performance airframe-drive system), is available and can be added on directly with no guesswork. (If you'd rather source your own equipment, the model is available as an ARF alone.) The XR-61 flies with extreme stability, like a giant-scale plane, yet fits easily in most vehicles. Intermediate and advanced pilots will thoroughly appreciate how awesome it can be learning to fly low and slow 3D and tearing up the air.

SPECIFICATIONS

MODEL: XR-61
MANUFACTURER: Precision Aerobatics (precisionaerobatics.com)
TYPE: Aerobatic monoplane
LENGTH: 57 in.
WINGSPAN: 61 in.
WING AREA: 807 sq. in.
WEIGHT: 70.5 oz.
WING LOADING: 12.59 oz./sq. ft.
MOTOR REQ'D: Thrust 50
RADIO REQ'D: 4+-channel
PRICE: $300

GEAR USED

RADIO: Spektrum DX18G2 w/ AR8000 receiver (spektrumrc.com); four Hitec HS-5245 servos (hitecrcd.com)
MOTOR: Thrust 50 w/ Quantum 70 Pro
BATTERIES: Two Hobby People 3S 2200mAh in series for 6S (hobbypeople.net) and one Thunder Power 6S 2200mAh (thunderpowerrc.com)
PROPELLERS: Vox 15x8 and 16x6

HIGHLIGHTS

- Well engineered and constructed
- Extremely lightweight
- Outstanding slow-flight characteristics
- Battery options work well

UNIQUE FEATURES

If this is your first plane from Precision Aerobatics, you will smile when you feast your eyes on the model's interior. There is a lot of carbon fiber in there, and it is easy to see how much thought went into where and how each piece was implemented. Everywhere else inside the fuselage looks like Swiss cheese, with lots and lots of huge lightening holes. The covering combination employs an aggressive color scheme with a solid top and transparent wing bottom, which show off even more of the company's smart build methods. Pocket hinges for the ailerons are factory fare and create gapless hinge lines on the wings. CA hinges are used to hold the elevator and rudder in place, and using a pipette tip on my thin CA glue bottle really helped with the application of the adhesive. After installing the empennage,

Above: Ball links and Kevlar are included and allow the large control surfaces to come alive for aggressive flying. Left: The canopy locks in with magnets and a mechanical latch. There will be no unwanted departures. Right: The carbon-fiber spinner is of high quality and finishes the front end off perfectly. Below left: These clever devices help direct the flow of air over the wing for better control during high-alpha flight. Below right: The provided gear cuffs and look sweet against the carbon-fiber main gear.

you are instructed to seal the tail feathers' remaining two hinge gaps, and color-coordinated covering pieces are provided. A few minutes with a covering iron set to medium heat made the process painless and quick. When the air gaps of a hinge line are sealed, air can't blow through and create unwanted streams of turbulence, which can hinder performance, especially in high-alpha flight. Pulling around a 3D plane post-stall requires plenty of thrust, and the appropriately named Thrust 50 brushless outrunner is the perfect match for the airframe. At 487Kv, it was designed to run on a 22.2-volt (6S) electron source, and—here comes the cool part—you can run two 3S 2200mAh packs in series or use a single 6-cell battery. I wanted to try both, so I made and added a series adapter, allowing me to fly the XR-61 with either battery setup. Buying two 3S packs for about $20 works well, as individually they can be used in quite a few different aircraft. A cooling design is integrated in the motor and decreases temps. A Quantum 70 Pro speed control features a switching BEC, so running 6S and four digital servos is not an

Lots of carbon fiber and a lightweight design is the nature of this airplane. Using two 3S 2200mAh packs is a nice option.

issue. Hitec servos are provided in addition to the above-mentioned motor/speed control, which are all part of the aforementioned package available separately. A gorgeous fiberglass cowl, air baffles, carbon-fiber landing gear, gear cuffs, fiberglass wheel pants, and Kevlar pull-pull string are all included and help finish the XR-61 quite nicely. The instructions are well written, and there are plenty of images included, making the final assembly easily doable and in minimal time.

IN THE AIR

The Thrust 50 motor spins the 15x8 or 16x6 prop with ease. After trying both, I have to say that Precision Aerobatics' pilots are on point; the 15-inch prop is perfect all-around, while the 16x6 excels at "low and slow" flying. Short runways are not a problem with the power on tap. As for rolling around, the instructions guide you either to raise or lower the wheel pants in relation to the main gear, depending on your flying-field surface. In short grass and on a dirt runway, I found the wheels and pants to be fine at the lowest position, but with longer grass and weeds, one might want to remove them. With a stall speed around 13mph, this plane lands very predictably. Large ailerons, lots of wing area, and a lightweight airframe tend to be helpful that way.

GENERAL FLIGHT PERFORMANCE

Stability: This model airplane is stable at all speeds. From full throttle to post-stall, it never feels unstable. Ground stability is also perfect; taxiing around on the tarmac is easy.

Tracking: Only minor trimming was needed; a few clicks were added and then the plane flew across the sky without unwanted deviation. Tracking through maneuvers is also a point-and-shoot affair. The XR-61 can also be turned to and from any direction immediately with its oversize control surfaces and 2:1 thrust-to-weight ratio.

Aerobatics: The company's name and this aircraft type should give you a pretty good idea about the intentions and abilities of both. Any maneuver that you can dream up is doable. Being superlight decreases the inertia and some moves will feel different, but overall, it will do 3D with the best of them.

Glide and stall performance: Again, it is easy to revel about the weight of the XR-61; my model is 4.4 pounds ready to fly, with an added pilot figure and the added side-force generators! This fact lends itself to lightly loaded landings, the kind where you can spot-land if you practice. So the stall speed is more than predictable and comfortable. If you use idle power (keep the prop turning), the airframe will glide for quite a while with positive control.

PILOT DEBRIEFING

A lightweight airplane plus incredible propeller power equals serious fun. Low-and-slow 3D flying is serious fun, and the XR-61 excels at it. Pushing the throttle forward really pulls the plane around with authority, allowing more fun in the flight envelope.

BOTTOM LINE

The Precision Aerobatics' XR-61 and the ARF provisions package are well thought out and use high-quality components, which are engineered to save the most weight and deliver the lightest and best-flying aircraft you can throw your thumbs at. Add in the company's iPAs combo and you'll pretty much have everything needed to get this aerobat airborne. Depending on your style, the assembly can take anywhere from a day up to a few evenings to complete. The only extra item added on my end was a small wire tie to keep the elevator servo's wire from rubbing on the pull-pull strings in flight.

Roll It Up

As modelers, we work in some hard-to-reach areas at times, and getting things where they need to go can be challenging. One thing that I have found to help make life easier is rolling certain things to form radii or circles. This will aid when you need to clear obstacles, hold things in place, or get that pesky wire or strap in place.

HOOK AND LOOP. Rolling one end of a battery strap makes it much easier to fish it down through a battery tray on one side and back up the other. With the curved or curled end facing upward, I can typically guide it as it travels and guide it through the slot location intended for it. Try rolling your Velcro or similar fastener on one end, then see if it is any easier to get it where it needs to be.

WIRE TIE. As mentioned, I added a small tie in an area that almost seems impossible to install one. The trick was to use needle-nose pliers or a hemostat and wrap the tie around the tool a few times. When wrapped, I held it there for 20 seconds or so and then released it. The result was a corkscrew-looking wire-tie end that was easy to route around a tight corner, grab a wire, and then secure. I hope that these words make sense, but a picture is worth a few more. Just remember—patience is part of the hobby, so just breathe and take your time, or take a break if you get frustrated.

My trusty hemostat is great for this. Performing surgery on your aircraft shouldn't be difficult!

TEXT & PHOTOS BY **JOHN KAUK**

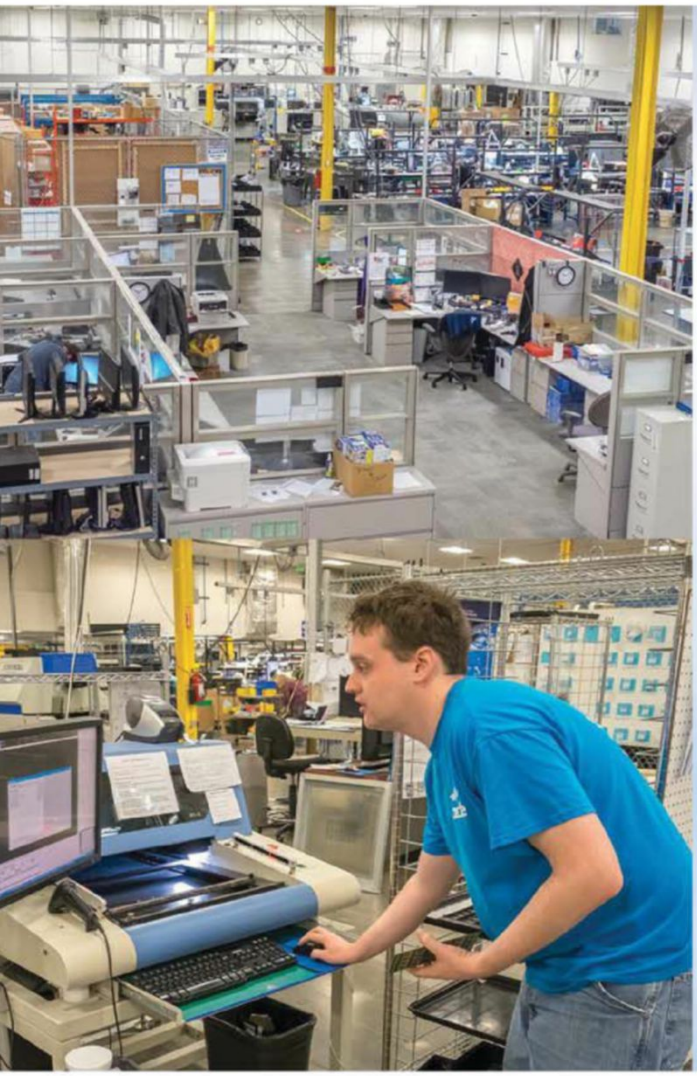
Brian O'Donnell, director of sales and marketing, displays a tray of populated circuit boards ready for final assembly into speed controls.

Behind the Scenes at **Castle Creations**

One great thing about writing this column is that I occasionally get to spend time with the manufacturers and importers who make modern RC modeling practical. I recently had an opportunity to tour the Kansas manufacturing plant of Castle Creations. Over the course of nearly 20 years, Castle has grown from a home-business startup to one of the largest and most important manufacturers in electric flight. Its thoroughly modern plant showcases the leading edge of electronics-assembly technology and lean manufacturing principles, and it is very impressive indeed.

Patrick del Castillo, then an engineer at Garmin, started the business when he decided he could build a better speed control for his electric planes than what was available at the time. I can remember Patrick participating in discussions on the old online forums on electric flight and selling the speed controls he made in his home at flying events like KRC. He was well positioned when electric power transitioned from brushed motors to brushless, and his business grew as electric RC became more widespread.

In 2000, Patrick was able to leave his job at Garmin and focus on the growing Castle Creations business. In 2003, the company moved into a 5,000-square-foot facility in Wellsville, Kansas, and the business continued to grow. As the RC industry expanded into ready-to-fly aircraft and ready-to-run cars and boats, demand from manufacturers for Castle Creations speed controls and



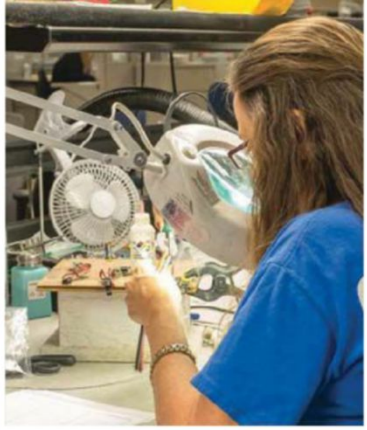
Top: This overall view of the Castle Creations engineering and manufacturing floor shows the scale of the operation: Two SMT manufacturing lines, up to four final-assembly lines, and parts and finished product storage all in one place—very impressive. Above: Patrick Adams, SMT manager, adjusts an AOI station. This device uses cameras and variable-angle lighting to inspect the placement and soldering of hundreds of components in a matter of moments. Above right: Dave Grife flies his impressive de Havilland Swallow at Mid America Electric Flies in July 2015. It's powered by a Jetfan 90 ducted fan driven by a NeuMotors 1518 with a Castle Creations Edge 130 on a 6S LiPo. Right: Castle's Phoenix Edge line is the latest evolution of its aircraft speed controls.

motors continued to expand. The year 2006 saw the company moving into a larger, 11,000-square-foot facility in downtown Olathe, Kansas. The OEM (original equipment manufacturer) business continued its rapid growth, and in 2010, Castle moved into its present 76,000-square-foot facility in Olathe, where it has room for future growth and product development.

Depending on demand for its products, Castle employs between 70 and 100 people at any given time. The front office houses the management, sales, and customer-service staffs, which usually number about 15 people. The 14-person engineering department designs, prototypes, and tests new products on-site. Except for the RC cars, drones, and other gear apparent in and around the cubicles, this part of the business looks like any other office you might encounter.

HOW SPEED CONTROLS ARE BORN

It's the huge engineering and manufacturing area that sets Castle Creations apart. Leaving the offices and walking around a corner reveals a vast open space full of workstations for engin eering, two surface-mount technology (SMT) manufacturing lines, reconfigurable final assembly lines, and storage areas for both parts and finished products. This part of Castle's facility is much bigger than I expected. To be honest, nothing prepared me for the sheer scale and sophistication of Castle's operation. This is a serious business enterprise, and you can't imagine how many products the company sends out the door. It's an interesting perspective on how large the RC world has become.



Above: An operator sets up the solder paste machine. In the background, reels of thousands of SMDs are stored in racks, ready for use in the P&P machine. Top: Employees hand-solder capacitors, wires, and leads to complete the assembly process. The computer screen in the background shows instructions for the particular device they're working on.

The manufacturing process starts at one of the two SMT lines. Each line has several computer-controlled machines that perform different operations in the manufacturing process. The small printed circuit boards (PCB) that make up each product come into the building in sheets made up of multiple PCBs. These sheets are put through the SMT line, for population with the various surface-mount devices (SMD), before being broken apart and sent to final assembly. The manufacturing process is complicated, precise, and technical, so what follows is a much-simplified description.

The first machine in the SMT line applies a solder paste to the PCB. It uses a sort of squeegee and screen, not unlike the way a silk-screened T-shirt is made, to precisely place small dabs of the solder paste on the PCB. The circuit board is then passed through to the pick-and-place (P&P) machine. An operator loads the P&P machine with the appropriate SMDs on feeder reels containing thousands of the tiny electronic components. Then, the P&P machine quickly picks up the SMDs and places them in the proper spot on each board. Take a look at the surface-mount components on one of your speed controls. Imagine two machines delicately setting those tiny components in place with precision down to a thousandth of an inch and doing it up to 1,100 times per minute. It's truly amazing to watch it happen.

After the sheet is fully populated, it's passed into an oven, which heats it to melt the solder paste and complete the process. If the board is a two-sided circuit, the sheet is taken back to the beginning for the other side to be populated. If not, it moves on to the inspection stage.

Castle uses an automated optical inspection (AOI) station to check the circuits for proper device placement and soldering. This machine uses cameras and variable-angle lighting to take photos of each sheet of circuit boards. A computer then checks the photos and can quickly identify PCBs with misplaced components or bad solder joints. The precise location of the problem component is marked on a report so that a technician can manually

correct the problem. As a testament to the accuracy of Castle's system, its process error rate is a mere 0.015%.

After the inspected sheets are broken out into individual circuit boards, they're sent to the final-assembly line. Instead of using a batch system where employees apply one part to a bunch of circuit boards, Castle has implemented a "flow" process. The first technician in a line takes a circuit board and completes a couple of operations on it before passing it to the next person in the line. This allows each person involved to check each board in addition to hand-soldering capacitors, wires, and leads into place. Each station in the assembly line has a computer screen that displays job instructions and diagrams for each step in the process. When the final assembly is completed, the product goes to a station in the line where it's powered up and tested before being packaged for shipment.

MADE IN KANSAS

To keep its products affordable, Castle Creations buys its SMDs and other electronic components in the global market, from suppliers who meet specifications at the best cost. Outside of that, every step in the product's life—from conception, design, and prototyping to manufacturing and final assembly—takes place in the Olathe facility. In this age of businesses outsourcing and moving production offshore, I think that's an admirable thing. It's amazing to see what Patrick del Castillo's home-based business has turned into.

Raytek MiniTemp MT4

Problems in electric-power systems often cause excess heat. A bad solder joint, a loose mechanical connection, an overloaded battery, or a wire gauge too small for the load, all these conditions will generate heat. When components get hot enough, they can be damaged or cause other problems, so it's important to be able to check temperatures.

Raytek's MiniTemp MT4 is a noncontact infrared thermometer with a laser pointer. Intended for use within a fairly short range, the circular area of measurement is about 1 inch in diameter at a measuring distance of about 8 inches. At a distance of 2 feet, the circle is about 3 inches in diameter, and the device works to a range of about 4 feet. The temperature-measurement span is from 0 to 750 degrees Fahrenheit.

To use the MiniTemp, simply point it at the target and pull the trigger. The red laser dot marks the approximate center of the measurement area, and the LCD display shows the temperature. The display will hold the last temperature measured for about seven seconds. The MT4 costs $79. **raytek-direct.com**

Small enough to fit easily in a pocket, the Raytek MiniTemp MT4 is easy to use and has a big backlit temperature display. In addition to its use in RC, it's pretty handy around the house, too.

TOWER HOBBIES CrazE Wing

Wild sport aerobatics at its best

BY **KEVIN SIEMONSEN** PHOTOS BY **PETER HALL**

The CrazE Wing from Tower Hobbies is an exciting sport-aerobatic flying-wing design that can be flown in a small park and can perform smooth loops and rolls with ease. This all-wood ARF airplane is perfect for intermediate through expert modelers, regardless of building skill. The kit comes with a high level of assembly already done at the factory, and it requires a minimum of shop tools to assemble. Because of its inherent maneuverability, the CrazE Wing would be a perfect choice for a one-design club pylon race or even an RC combat plane. The CrazE Wing packs a lot of punch in a small package. And with a 35.5-inch wingspan, it won't take up much space in your car, so it's perfect for quick flights during your lunch break.

SPECIFICATIONS

MODEL: CrazE Wing
MANUFACTURER: Tower Hobbies (towerhobbies.com)
TYPE: ARF aerobatic flying wing
WINGSPAN: 35.3 in.
LENGTH: 18.75 in.
WING AREA: 409 sq. in.
WEIGHT: 22 oz.
WING LOADING: 7.8 oz./sq. ft.
RADIO REQ'D: 3- to 4-channel (w/ elevon mix)
POWER REQ'D: 1000Kv brushless motor
PRICE: $49.99

GEAR USED

RADIO: Futaba 8FG Super w/ R617FS receiver and two Futaba S3115 servos (futabarc.com)
MOTOR: ElectriFly 1000Kv brushless motor and 40-amp speed control (electrifly.com)
BATTERY: FlightPower 4S 2100mAh LiPo (flightpowerbatteries.com)
PROPELLER: APC 8x8E (apcprop.com)

HIGHLIGHTS

- Lively and exciting to fly
- Easy to hand-launch
- Quick assembly time

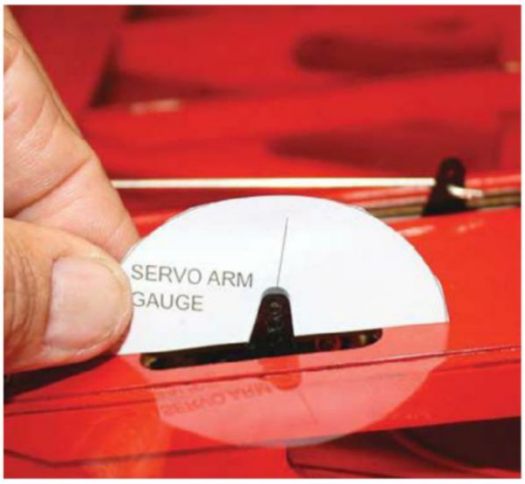

CrazE Wing

UNIQUE FEATURES

The all-wood built-up airframe comes nicely covered with transparent Monokote and is mostly fully assembled straight out of the box. Included are the airframe, control horns, pushrods, decals, hardware, and an instruction manual. The wing comes prehinged, with the elevons already installed at the factory, a big time- and effort saver. The engine pod/fuselage has indexing tabs, and it self-aligns with the center section of the wing. All you have to do is mix up some epoxy and glue it in place. The vertical fins are also keyed to fit into slots one rib bay out (left and right) from the center. The ribs that the fins are glued to have plywood reinforcement. This makes them more than strong enough to handle the additional flight loads. The stick-on decals must be cut out individually from the decal sheet, so you should trim them close to minimize the clear outline.

Radio installation is straightforward, requiring that only two micro servos, a receiver, and speed control with BEC need to be installed. The servos are installed on small wooden standoffs on the underside of the radio hatch. Before installing the two Futaba S3115 micro servos, I positioned and glued in place the wooden blocks using a dab of epoxy. The instructions indicate the importance of drilling pilot holes in the blocks before installing the servo screws. If you don't do this, you could split the blocks. Also included in the booklet are servo-arm guides to align the arms for the appropriate amount of travel. I like the Tower Hobbies manual because has great detail, and it even shows the recommended holes in the servo arm to install the control linkages. The control-horn locations must be identified and mounting holes drilled prior to installation. The hardware package includes pushrod keepers to hold the linkages in place, but I opted to use Z-bend pliers instead for the pushrod-to-servo connections. When setting up the control deflections, another paper guide is used to locate the elevator's recommended deflection amount.

To control the servos, I used my Futaba R617FS 7-channel receiver and attached it in place with a small piece of hook-and-loop fastening tape. There are blind nuts installed in the firewall, and the 1000Kv brushless 77G outrunner brushless motor that I used screws directly in place with the included machine screws. A large hatch allows access to the inside of the engine mount pod, and it is secured in place with a couple of rare-earth magnets. There's plenty of room for the 40-amp brushless motor speed control, and it too is held in place with hook-and-loop fastener and plugs directly to the motor leads. The motor has a prop adapter, and the APC 8x8E prop is easy to attach. I used a FlightPower 4S 2100mAh LiPo battery pack to complete the power system. For safety, make



Printed guides are included in the instruction manual, and they make setting up the model's control linkages easy.

The main hatch cover is held in place with magnets.

Inside the radio compartment is plenty of room, and everything needed fits nicely into place.

No, there are no functional rudders in the vertical fins. If you experience any adverse yaw, try adding some aileron differential.

sure that you double-check the motor direction prior to installing the propeller.

IN THE AIR

Not really knowing what to expect when I first took the CrazE Wing to the flying field, I can honestly say that the CrazE Wing wasn't crazy at all. It was, however, exhilarating to fly. After the hand launch, the plane is up to flying speed in the blink of an eye. With power on, it burns holes in the sky at a high rate of speed. The CrazE Wing is definitely different from all my other planes, and it is exciting to fly. Throttled back and on low rates, it is well behaved and stable.

My first hand launch was at about half throttle, and the CrazE Wing got up on step with no unwanted torque rolling or overpitching response. I did add a significant amount of downtrim, but then it was hands-free solid.

It took a couple of tries, but I eventually found that a simple overhead toss with a bit less than half throttle does the trick.

GENERAL FLIGHT PERFORMANCE

Stability: Even though the CrazE Wing is a flying wing, it proved to handle far beyond my expectations. Takeoffs require a minimum of power, and the launches are quite predictable. The model has a minimal amount of frontal area, so it is quite slippery and fast as a result. Slowing down is the only time that you can tell that you're not flying a typical airplane as it will porpoise a bit on the elevator with power off. This is more notable when the center of gravity (CG) is placed farther forward.

Tracking: After moving the CG back slightly, the elevator-porpoising sensation was reduced. At speed, the CrazE Wing tracks like any sport plane, and it felt as if it were on rails even during looping and rolling. When the nose was high and I applied some aileron, there was a slight amount of yaw, which makes sense since there is no rudder. Dialing in a little bit of aileron differential would help eliminate that.

Aerobatics: The CrazE Wing might as well be called a "roller coaster on wings." It rocks and rolls all at a high rate of speed, which is exciting no matter how you look at it. Inverted flight is just as solid as right side up and equally as impressive. Besides high-energy aerobatics, you are somewhat limited, but steep bank turns are tight and fast!

Glide and stall performance: The CrazE Wing is far from a glider, but it keeps its speed up, and the occasional landing approach goes longer than expected. Landings are uneventful. Glide it in as shallow as possible, and throttle back to prevent damage to the prop. With reduced power and increased elevator input, the CrazE Wing will begin to indicate a stall. Just like a traditional airplane, keeping the elevator input in will eventually get you into a deeper stall, where the wing and nose drop. Simply reduce elevator or add power to recover instantly from the stall.

PILOT DEBRIEFING

The very best part of flying the CrazE Wing is its low and fast passes with steep banking turns down on the deck. I have flown the model in moderate winds, and it remained stable and easy to control. The hardest things to get used to are the launches and landings.

BOTTOM LINE

The CrazE Wing is well constructed and easily withstood my landing abuse. The plane is definitely different, and that fact alone makes it fun for me. In any case, the CrazE Wing is inexpensive and a hot little aerobat to fly. You'll love it!

Elevon Control

Whenever you fly a delta wing or any other tailless flying-wing design, you have to activate the elevon feature of your transmitter. Elevon control combines aileron and elevator controls, so your two control surfaces take care of pitch and roll response. This is as simple as flipping a switch on less-complicated transmitters, or you can go into your program menu of your computer radio and active it in the advanced menu. Once elevon is active, your channel setup with your receiver will need to be channel 1 for left elevator and channel 2 for right elevator. Next, go into reverse in the basic menu, and reverse both channels 1 and 2. Once properly set up, you should be able to raise the right elevon and lower your left elevon by moving the stick to the right. You should also be able to raise both elevons by moving your stick back to the up position. You can then set your rates setting as needed after a test flight or two to dial in the response you like.

Setting up elevon control is easy. All that's needed are two servos—one attached to each aileron/elevon—and the transmitter mixes roll and pitch control automatically.

HOW TO

Fiberglass a Wing

TIPS FOR PRODUCING A SMOOTH FLYING SURFACE

BY **DENNY DEWEESE** PHOTOS BY **FRANK TIANO**

Our current project is a giant-scale Grumman Hellcat. As you can see, the wing has been finished nicely with fiberglass cloth and resin and is ready to prime. The fuselage was finished earlier and already wears a coat or two of primer.

There are many ways to apply fiberglass cloth to a structure. The most common methods use either polyester or epoxy resin and catalysts. Some of the resins require unequal mix ratios, like 1 part epoxy to 2 parts hardener, which is difficult to measure accurately. I also dislike polyester resin because it really smells foul. For all these reasons, I now use Pacer Technology's Z-Poxy Finishing Resin (#PT40). It is an equal-mix product that has little to no smell and is easy to work with. Cure time to a tacky consistency is about 30 to 45 minutes. After about two hours you can handle it, and after four to five hours, you can sand it or apply another coat. Even if you have never done this before, it is really easy to do.

YOU'LL NEED **The components shown here are needed to start the project. The method I use will work with any resin, whether it is polyester or epoxy based; I chose this Z-Poxy product because I enjoy its working characteristics. Your scissors must be sharp. I use denatured alcohol for thinning or cleaning up the tools, but rubbing alcohol will also work.**

LET'S GET STARTED

Some items you will need are paper towels, 1-inch hardware-store chip brushes, something stiff to use as a "squeegee" (a credit card works great, as do plastic-coated playing cards), a hobby knife with no. 11 blades, Z-Poxy Finishing Resin, and some denatured alcohol. A flat surface, like an old table or workbench, covered with newsprint or some other disposable covering is excellent for setting parts on. You will also need some 100- and 220-grit sandpaper to smooth out your prep work. A rubber sanding block, available at most hardware stores, will help enormously. Oh yes, and some 5-oz. disposable drinking cups will be useful for mixing the resin.

Keep in mind that different-weight fiberglass cloths (from 3/4 to 3 oz.) work differently. The heavier the cloth, the more stubborn it may be to lay down properly—be patient. Whether it is a one-piece or a two-piece wing, pretend that it's divided into four quadrants: top left, top right, bottom left, and bottom right. It doesn't make a difference which section you start with. If you have detachable ailerons and flaps, remove them and do them separately. Now, let's get down to business.

PREPARATION

Before you start the first panel, make sure that the whole wing has been finish-sanded with 220-grit sandpaper and then vacuumed clean. Do the other three panels in the same way. If your balsa wing has any dents in it, spray the dented area with a little water and gently rub it into the dent. Let the area dry out; the wood grain will lift slightly, causing the dent to vanish like magic! The general idea here is to have smooth, flat, ding-free surfaces over which to lay your fiberglass cloth. As far as fiberglass cloth goes, my basic guide to what weight to use is directly related to airplane size. For models with wingspans in the 80-inch range, you can use anything from 3/4- to 1 1/2-oz. cloth. Anything 100 inches and over, I use 2- to 3-oz. cloth. You get the idea. To find where to buy your glass cloth, check hobby shops or large distributors. You can also shop around your local boat/marine hardware stores for the cloth you need. Now, measure your wing panels and allow at least an inch of waste material all the way around. After cutting your first piece of cloth, lay it on top of the wing panel and rub your hand over it to make sure that there is nothing under it, as any speck of sanding dust will ruin the finish.

THE GLASS ACT

For the first coat of resin, I add about 5 to 10 percent alcohol to the resin. This is not really recommended by the manufacturer because of the variances of alcohol used. But it helps the cloth lie down easier without pulling it out of shape while applying the resin. When you

1 I cut the cloth a little oversize, lay it over the surface, and dry-brush any wrinkles out. I pour the mixed Z-Poxy down the center, from root to tip (as shown), and prepare to "squeegee" the resin through the cloth.

2 Using a clean credit card or plastic spreader, I spread the resin toward the leading and trailing edges, to a point where there are no ridges of resin visible.

3 After completely spreading the resin, this is what the surface will look like. Once the resin has cured, the excess fiberglass cloth can be easily trimmed using a single-edge razor blade or lightly sanded using a sanding block. Here, the wax paper protects the flaps from the resin, but the flaps are in only to make sure that the trailing edge cured straight; normally, I would take the flaps out.

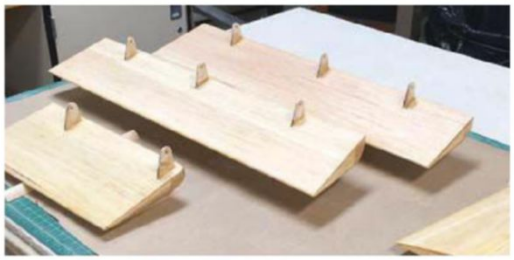
apply the second coat of resin, however, use it full strength. Mix the resin parts together completely, add the alcohol, and mix again until the alcohol is fully integrated.

Lay the cloth down over the bare balsa, being sure that it lies down completely smooth. Pour a small line of the mixed resin down the center of the wing panel spanwise, and spread it out from the center to the leading or trailing edge—it doesn't matter which—then do the rest. Keep a disposable drinking cup handy to squeegee off excess resin from your credit or playing card. Paper towels are nice to have around, too, as well as a 1-inch chip brush to brush down the edges and areas that you missed. Now, spend some time going over those areas; fixing it now makes life a lot easier later on.

By this time, your hands will feel as if you just handled a large ball of cotton candy—nice and sticky. Wipe yourself and any tools you wish to keep clean using a paper towel and some alcohol. Trust me—once you have completed the first panel, you will find the other three will go much faster. I usually do the top-left panel followed by the top-right panel and then let cure. I trim the edges with a no. 11 hobby blade and then lightly sand the edges all the way around. I flip the wing panels over and apply cloth to the other side. Don't build up too much resin near any edges because, when it cures, you will just have more resin to sand off.

After you've done all four panels and they're all fully cured, revisit the first panel and very lightly sand and fix any little imperfections or dings that you might have picked up. If you have any wrinkles, bubbles, or brush hairs, now is the time to sand them away. If you must sand down so far through the cloth and resin that it leaves a bare spot, don't worry. You can cut a small piece of cloth and put it down with the second coat of resin, or if it's small enough (like the size of a quarter), just ignore it and put down the second coat of resin directly over the bare wood. Go over the other three panels and do the same thing. As for the wingtips, I simply trim close to the wing, apply resin, let cure, and then sand. If needed, I'll add scrap cloth to cover any bare spots.

Once you have all four panels done with two coats of resin and they are fully cured, you can use the sanding block to sand the wing smooth. You will notice that the second coat of resin has cured fairly shiny. This is because it just lies on top and does not absorb at all into the wood or the glass cloth. Use 100-grit sandpaper over the shiny surfaces to "break" the shine, then switch over to a finer-grit sandpaper, like 220, to finish-sand the whole panel. Remember that when you sand the cloth, be careful not to go through to bare wood. The difference now between a good wing surface and an outstanding one is how much time you spend sanding the wing.



4 Above and left: Notice how neat and clean the surfaces appear after sanding the second coat of resin. All surfaces are now ready for primer. Because the second coat of resin does not seep into the wood grain, it forms a crisp topcoat layer, which is very shiny. Sanding it until dull is appropriate.

5 Below: A small vibrating sander can be helpful in breaking down the glossy topcoat of resin. The more pressure you apply, the faster it works. But be careful not to apply too much pressure on the corners—you may go through your cloth! Touch up using a sanding block.

6 **The fiberglassed and sanded wing panels for the big Hellcat I'm working on are just about ready for primer, as soon as I finish-sand the inboard edges of the panels.**

7 **The same basic technique is done for all control surfaces, as shown here. The parts are set aside until the resin cures, then the excess cloth is trimmed away and sanded smooth using sandpaper.**

8 **For strength, I always glass the wheel-well interiors.**

When you have the entire wing finished as mentioned above, you are just about done. For me, the next part is the final step. Find a well-ventilated area, and get some Rust-Oleum Automotive gray primer (an average rattle can will cover about 4 square feet) and lightly spray the wing panels. The primer will expose any flaws left in your fiberglass surfaces. Fill any pinholes or dings using a lacquer spot putty or Bondo, let dry, and sand and primer again. From here, there are many ways to finish the wing, but that's another story.

BY **PAUL TRADELIUS**

This is a picture of the author, taken some years ago, with two of his scale helicopters. It took a lot of work to get these reflex wooden rotor blades sanded, covered, and balanced, but just watching them in flight made it all worthwhile.

Mounting and Balancing Rotor Blades

Rotor blades have come a long way since I entered this hobby more years ago than I care to admit. Way back then, we had the advantage of buying rotor blades not only of varying lengths but also of varying chords and airfoils. We also had rotor blades with square tips, angled tips, round tips, a tapered blade from root to tip, and some blades even had washout that allowed the rotor blade to delay the stall at the blade tip. Different airfoils were also available. Some blades were flat bottomed, which were particularly useful for scale applications, while other blades had a reflex airfoil for improved autorotations; and of course, there was the full symmetrical airfoil for aerobatics. That was the good news.

The not-so-good news was that all of these rotor blades were made out of wood, and none came ready to fly. They were fairly rough-cut from wood, so each had to be finely sanded to produce a smooth surface. Each blade was covered with a vinyl-type material that had an adhesive on one side, much like shelving paper. This material had to be trimmed in such a way that the edges would not catch the air or the covering would be blown off in flight. The next step was to cut the covering around the root of the blade so that a mounting reinforcement could be glued in place. As a final step, you had to put a little epoxy on the exposed wood tips to keep them from attracting dirt and moisture. As you can imagine, this was a tedious process and one that required a certain amount of knowledge, skill, and patience.

In this day and age, I don't think you can even find one of these wooden rotor-blade kits—that is, except in my attic, where I might have one or two left. The good news is that we are now in the buy-and-fly mode. Although we don't have the variety of different types and styles of rotor blades as before, it's much easier to purchase a set of composite rotor blades, install them on your helicopter in a couple of minutes, then go fly. In most cases, this works out very well. The companies do an excellent job of matching rotor blades so that they are ready to fly right out of the box.

Because I am old school, however, I still check the blades' balance to discover if they need a little tweaking here and there. I certainly don't think we can eliminate all vibration in our helicopters, but this extra effort at least will reduce the potential for unwanted vibration. Let's take a closer look at how I do it.

BALANCING ROTOR BLADES

Checking the chordwise balance of your rotor blades is a very simple, quick, and inexpensive process. All you will need is a round pencil and a suitable gram scale, which can be purchased at an office-supply store for less than $20.

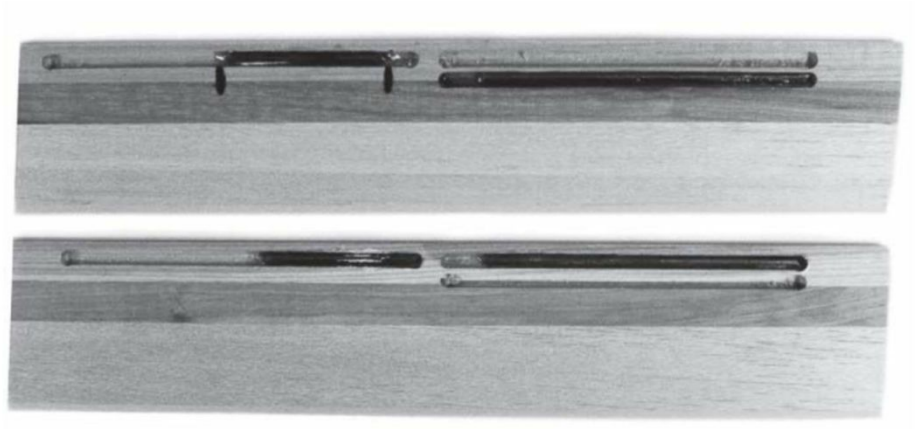
The first step is to weigh each rotor blade on a gram scale, which should be accurate to 1/10 of a gram. It's great if both blades weigh the same, but that is rarely the case. If their weight is slightly off, place a small piece of covering material on the light blade until the weight matches that of the heavier blade. It's better to apply a slightly larger piece of covering than needed, and then cut off a tiny amount as you continue to weigh the blade. Keep the backing on the covering material to cover the sticky side, however, and do not apply the covering material until the next step. On a flat, smooth table (without any fans or air-conditioning going), place the heavy rotor blade on a round pencil and rotate the pencil to find the center of gravity (CG). Mark the balance point, which is centered on top of the pencil, with a pencil and transfer this mark exactly to the light blade. Place the light rotor blade on the pencil and move the covering material as needed to bring the blade in balance over the mark you just transferred. Be careful when applying the covering to the blade: Wrap it evenly around the leading edge of the blade so that the oncoming wind will press it in place. Each rotor blade now will have the same weight and the same balance point, and they will be ready to mount onto the helicopter.

MOUNTING ROTOR BLADES

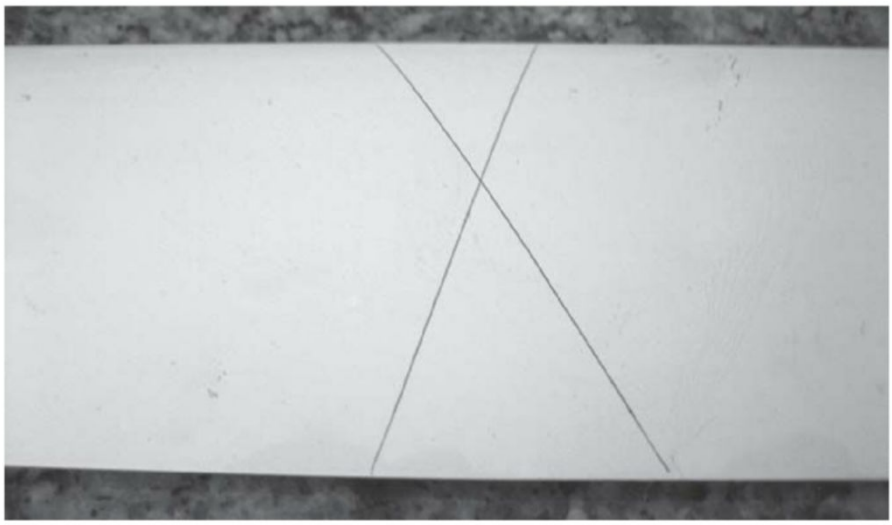
Mounting rotor blades requires a certain understanding of how each rotor blade reacts in flight. As the helicopter maneuvers, the lift throughout the rotor disc changes to vary the lift. This is accomplished by changing the angle of attack of each rotor blade as it completes one revolution. As the angle of attack is increased on one portion of the rotor disc and decreased on another, the helicopter will rotate in the direction of least lift. As the angle of attack of the blade is increased, however, the induced drag of that rotor blade is also increased. This increased drag will have a tendency to move the rotor blade back from its normal extended position. As you can imagine, even the slightest movement of the rotor blade will cause the entire disc to vibrate.

A rather obvious solution would be to tighten the rotor blade to its blade grip to eliminate this movement. That is virtually impossible, however, because we have no idea when the rotor blade is in its correct and fully extended position. Therefore, when mounting the rotor blade to the blade grip, it should be mounted loose enough to allow the centrifugal force to bring it into its correct position but not loose enough to where it will swing freely back and forth as the angle of attack changes. The technique I use is to tighten the rotor blade to the grip just enough so that it will maintain its position when the rotor disc is rotated 90 degrees but still loose enough that it can be moved with your hand.

Wooden rotor blades came with many different airfoils to optimize this type of flying. They were also available with standard square tips, round tips, or the angled tips shown here.



It was common for wooden rotor blades to come with slots that would accept lead strips to add weight to the blades. Light rotor blades were used for aerobatics, while heavier ones were used for hovering and scale applications.



By balancing the rotor blade at two different angles, the chordwise CG can be found at the intersection of the two balance lines. A more forward CG is used for stability, while an aft CG is better for aerobatics.

A digital gram scale, accurate to 1/10th of a gram, makes it easy to find the weight of each rotor blade. These scales are inexpensive and readily available at office-supply stores.

REPAIRING ROTOR BLADES

As a general rule, it's almost impossible to repair a damaged rotor blade. Years ago, with wooden rotor blades, it was possible to remove the covering and make minor repairs to the blade. Because everyone now uses some type of composite rotor blade, however, these repairs are very limited.

If you go through the above balancing technique with a new set of rotor blades, they should be as vibration-free as you can get them. I have seen, however, where a good set of rotor blades seem to lose their balance over time, as witnessed by a slight amount of vibration in the helicopter. Because rotor blades can't just lose their balance, there has to be a reason—and here it might take a little detective work to find the cause.

One of the first things I check in such a situation is the mounting hole on the rotor blade. Large, heavy rotor blades, turning at a high rpm, produce a tremendous amount of centrifugal force, and it is possible for the mounting hole to elongate slightly. Even the smallest amount of elongation will take them out of balance. If this is the case, however, I have not found a suitable repair method. The blades have given you all they have to offer, and it's best to replace them and install a new set.

A more common problem is what we used to call "hangar rash." This is just the normal bumps and bruises everything gets from normal use. It could be that you hit the blade on something or scraped the tips slightly in the grass or dirt. If this is the case, it should be fairly easy to repair with some CA or filler, as long as the problem is not near the structural part of the blade. And once the repair is made, be sure to go through the balancing technique I mentioned above. A smooth helicopter with a well-balanced set of rotor blades will allow your helicopter to perform at its best and give you many hours of fun flying.

BLADE/HORIZON HOBBY
Trio 360 CFX

A 3-blade mini with amazing agility

BY **JIM RYAN** PHOTOS BY **JIM RYAN & JOHN KAUK**

Three-blade rotor heads are an exciting development for aerobatic helicopters. With increased blade mass and area, three blades make for both greater stability and increased response. Blade RC previously offered a 3-blade head as an aftermarket option for its outstanding Blade 360 CFX, but the new Trio 360 saves both time and money with a ready-to-fly package.

The Blade Trio 360 CFX brings 3-blade performance to the already-excellent Blade 360. The agility of the new version is impressive.

You can tell by the photo that the author is pleased with this mini heli–copter, which adds the advantage of a 3–blade head to an already outstanding flier.

SPECIFICATIONS

MODEL: Blade Trio 360 CFX BNF Basic
MANUFACTURER: Blade RC (bladehelis.com)
DISTRIBUTOR: Horizon Hobby (horizonhobby.com)
TYPE: Mini 3-blade 3D helicopter
LENGTH: 26.38 in.
ROTOR DIAMETER: 31.10 in.
WEIGHT: 31.6 oz.
POWER REQ'D: 6S 1300mAh battery
PRICE: $599.99

GEAR USED

RADIO: Spektrum DX9 transmitter and AR7210BX receiver (spektrumrc.com)
SERVOS: Spektrum H3050 (cyclic) and H3060 (tail) (installed)
MOTOR: Blade 360 CFX motor (1800Kv) w/ Castle Creations Talon 35 speed control (installed)
BATTERY: E-flite 1300-6S (e-fliterc.com)

HIGHLIGHTS

- Responsive 3-blade rotor head
- 6S power and 360mm blades
- Excellent fit and finish
- Completely ready to fly, except radio programming

UNIQUE FEATURES

Like the regular 360 CFX, the Trio 360 features 6-cell power in place of the 3S system traditional for mini-class helis. With the greater power demands of a 3-blade layout, 6S power makes even more sense. The Trio has almost 100 per-cent part commonality with the regular 360, making them ideal stablemates when it comes to maintenance and repairs.

The Trio 360 comes as a BNF (bind-n-fly) version. Simply charge the battery, program your transmitter, and bind the receiver and you're off to the field. The Spektrum/BeastX flybarless receiver is preprogrammed, and all mechanical adjustments are preset. The updated AR7210BX features digital sensors, allowing rotation rates up to 2,000 degrees per second. You can also purchase a software upgrade directly from BeastX to add Panic Recovery, which will return the helicopter to upright flight at the flick of a switch.

The mechanics are both simple and tough. The carbon frames are durable, and the mounts for the one-piece plastic landing skids are aluminum, making it unlikely that a minor crash will damage the main frame.

The bearing blocks for the main shaft have integrated 120-degree radial mounts for the cyclic servos, and the servo arms are stout molded nylon. The flybarless head is also all CNC machined, with the swash driver integral to the head block. The tail is belt driven, and the blade tension is preset. The overall fit and finish is excellent.

The first step is to charge a 6S 1300mAh flight battery, as the setup takes just minutes. The brief manual covers all important details, including radio settings, preflight testing, and exploded views of all subassemblies. The main setup task is to program the recommended settings into your transmitter. You can do this manually or download the template from Blade RC's website.

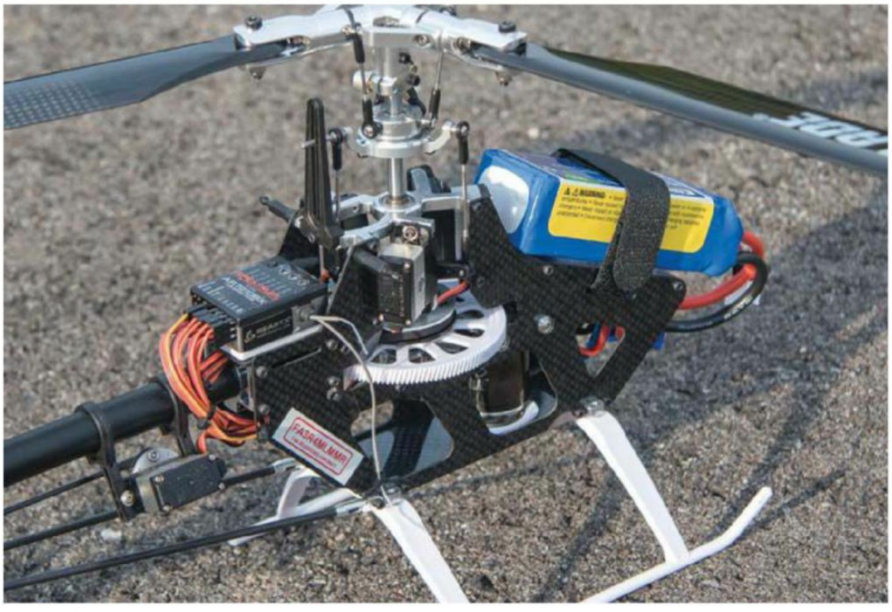
The Trio 360 includes a Castle Creations Talon 35 speed control that comes preprogrammed for Governor mode, with 2,600rpm in Normal mode; 2,800 in Idle Up 1; and 3,000 in Idle Up 2.

The H3050 digital cyclic servos have 36 oz.-in. of torque and 0.053-second transit speed, and the speedy H3060 tail servo has a transit time of just 0.029 second. All servos have metal gears. With the radio programmed and the battery charged, the Trio is ready to fly.

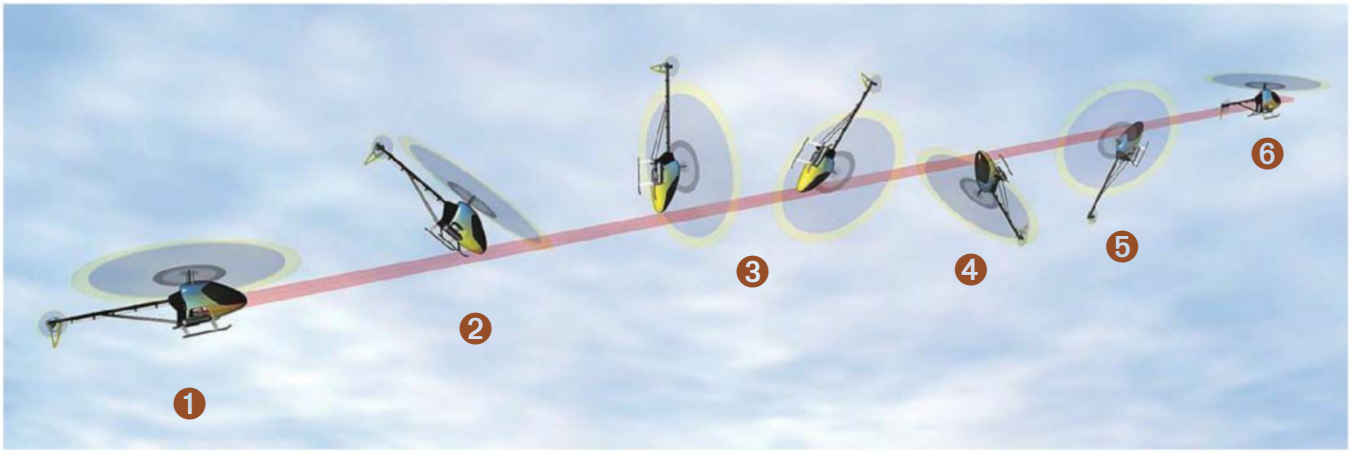
IN THE AIR

The manual recommended 100/85 for dual rates on all primary flight controls. Knowing that 3-blade rotors tend to make for a very responsive machine and because my DX9 transmitter supports triple rates, I programmed 100/85/70 for the rates and also programmed 10% expo.

The stock setup seemed just about right as the Trio flew beautifully from the initial takeoff. I found it noticeably more responsive than my



Above: The Trio 360 comes out of the box completely preassembled, with all mechanical adjustments complete. Simply bind your Spektrum transmitter and charge the 6S battery, and you're ready to fly. **Left and below:** The mechanics are simple and robust. The servo cluster is well designed, and everything is easily accessible. The Spektrum/BeastX AR7210BX flybarless receiver comes preprogrammed. The Trio offers outstanding performance in a compact package. One minor quibble is that the grips don't allow the blades to fold completely all the way back to the boom.



stock Blade 360, and I was happy with the reduced rates. With the greater "bite" of the 3-blade layout, I found collective pitch also extremely responsive, and for Normal mode, I ended up adjusting the pitch curve to 30–40–50–70–90 to make it easier to maintain altitude. This small change felt just right for Normal mode, while still offering full pitch response in Idle Up.

With the greater current draw of the 3-blade layout, flight time tends to be a little shorter. Blade recommends setting the flight timer for three minutes for heavy 3D in Idle Up 2, but duration is four minutes plus in Normal mode.

GENERAL FLIGHT PERFORMANCE

Stability: With 50 percent greater rotor mass, 3-blade heads tend to have greater static stability than conventional helicopters, and I certainly noticed this with the Trio. It seems to handle gusty wind conditions a little better than most helis in its class. It handles like a somewhat larger helicopter.

Tracking: With the pretuned BeastX, the Trio tracks very well in cruising flight. I saw no tendency to porpoise, and yaw control with the extremely fast tail servo is excellent.

Aerobatics: The 6S power system provides loads of power. Compared to the stock 360, the Trio is noticeably more responsive, both in cyclic and collective. The flip rate is scary fast, and I think many pilots may be happiest around 85% rates.

Landing: The Trio is very docile in Normal mode and low rates, so landings are silky smooth. Just click to Normal mode and make a normal approach.

PILOT DEBRIEFING

The Blade Trio 360 CFX is a very responsive machine with outstanding looks. If you've been wanting to try out the 3-blade format in an affordable package, the Trio is an excellent choice.

BOTTOM LINE

The Blade Trio 360 CFX adds the performance advantage of a 3-blade head to an already outstanding mini-class helicopter. The quality and performance are both outstanding. ✚

The Tumble

This 3D maneuver can only be performed by a fully aerobatic RC heli, like the Trio 360. The move is a series of flips, during which the heli slowly travels forward. The move can also be done backward and even in circles.

Step 1. Begin the tumble from slow forward flight by increasing collective while adding forward cyclic, making the model rise slightly while the nose is pushing down and the heli is slowly moving forward.

Step 2. As the model's tail approaches vertical (tail up), slightly increase forward cyclic to continue the forward rotation and keep the model moving forward. Smoothly start to reduce collective to near midstick (around 0 degrees pitch) after the tail passes vertical.

Step 3. Continue smoothly reducing the collective to slightly less than 1/2 stick to the start of introducing negative pitch; this will provide lift while the model is approaching full inverted flight.

Step 4. With the model's tail not quite at vertical (tail down), give a fairly large quick "stab" of negative pitch not only to stop the model from falling but also to give a little forward momentum to increase forward speed. Maintain forward cyclic to continue the forward tumble.

Step 5. As the model passes vertical (tail down), start moving the collective back to positive, about 3/4 stick, because the model is tumbling back to forward flight, and start reducing forward cyclic.

Step 6. Stop adding forward cyclic when the model is upright and slightly nose-down, and increase throttle to the desired speed to exit.

The Trio is nearly identical to its stablemate, the stock Blade 360 CFX. In flying the two side by side, the 3-blade layout demonstrates a noticeable difference in handling.

With just a bit of extra work, this Nieuport 28 looks much more realistic and scale than it did as a stock ARF.

HOW TO

Multiwing Makeover

NIEUPORT 28 GETS A SCALE UPGRADE

BY **MARK WILKINS**

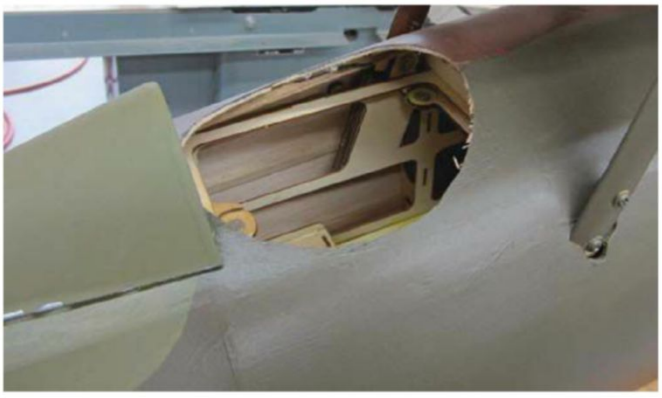
The Nieuport 28 is perhaps the most beautiful of the Nieuport series of aircraft, which began with the humble Nieuports 10, 11, and 12—the N-11 *Bébé* achieving notoriety as the plane that ended the Fokker Scourge of 1915 and the aircraft initially used by the Lafayette Escadrille. The Nieuports were all designed by the same man: Gustave Delage, who was a staunch believer in the one-and-one-half winged biplanes, or sesquiplanes. He held tenaciously to this concept right up through the Nieuport 27—another favorite of mine due to its semi-rounded fuselage. Feeling the pressure from other designers, such as Sopwith, SPAD, and Fokker, and weary of the criticisms of the single-spar lower-wing design, which had a tendency to flutter and tear away during extreme dives, Delage capitulated with his first true biplane: the Nieuport 28.

A vintage photo showing a squadron of Nieuport 28s preparing for a mission during WW I.

The N-28 is full of eye-pleasing curves, such as the rounded wingtips, fully rounded and elegantly tapering fuselage, beautiful tail feathers, and interesting flat (no dihedral) bottom wing with slight dihedral on the top, giving the wings a slightly flaring look when seen from the front. The N-28s, unfortunately, arrived too late in the war to see front-line service in strength by the French, as the swift and rugged SPADs were gaining favor with (some) pilots and French officials. So the French gave the United States their first fighters—squadrons such as the 94th and 95th were fully equipped with Nieuport 28s and were flown by aces Eddie Rickenbacker and James Meissner. It seems that, although the Nieuport 28s didn't suffer from the lower-wing failure of its predecessors, it traded this fault for upper-wing failure from the leading edge to the first spar! This was due to a poor joint between the nose rib and main spar joint, which under load in an extreme dive would fracture, causing this portion of the upper wing to shear away! This fault was ultimately corrected, but it was too late for the beautiful but already obsolete Nieuport 28. From here on out, it was all about speed and firepower. As a famous ace once said, "Death flies faster!"

Out of the box, the Nieuport 28 ARF is a nicely done model, but it has a lot of potential for a scale upgrade in paint and detail.

The stock wing comes with the basic camo scheme applied but it is not very scale, so I repainted it as well as the rest of the model with craft paints and then added some additional scale markings.



A big improvement is making the cockpit opening the scale round shape instead of the stock, unscale square shape.

A good way to improve the appearence of the "Hat in Ring" decal is to remove the clear portions. This removes the telltail "flash." Also, a little white paint will correct the hat rim, which should appear over the red ring.

The Maxford Nieuport 28 is a tremendous value for your hard-earned dollars. It features a fairly faithful rendition of the famous fighter, and the markings provided are for the "Hat in Ring" 94th Aero Squadron. It features the option for gas, glow, or electric power, and has the characteristic telescoping engine box, which allows for accurate positioning of the powerplant of choice. It includes all pushrods and a nice flying wire package. It also includes a beautiful fiberglass cowl painted in authentic colors. Being a scale nut, I saw this model as an excellent opportunity to push it a little further. After scrutinizing the plane and its gear, I decided to keep the 94th Aero Squadron markings but make the following modifications: change the number from "12" to "14," paint it a camouflage scheme characteristic of the period, add a suspension for the landing gear, replace the cockpit opening (the correct round one instead of a square one), install wooden interplane struts, use a more scale rigging arrangement, install scale Vickers machine guns, and add a pilot.

PAINT SCHEME AND MARKINGS

Working from biggest to smallest tasks, I chose to begin by painting the model in an authentic multicolored camouflage scheme: the colors I chose were light olive, olive drab, sand, leather brown, and black. Many SPADS were also painted in this scheme. I painted my model using acrylic craft paints available from A. C. Moore and Michaels. They are inexpensive and fairly easy to apply—Krylon makes a perfect leather brown spray paint, so I used this for the brown. You can also use Krylon flat black for the black if you prefer, although my craft paint did the job just fine. Depending on the color, two to three coats were required for decent coverage. The base beige that covers most of the model is perfect for the lower-wing surfaces, so this was only weathered slightly to accentuate the wing ribs. This is also a good time to address the square cockpit opening. To make a round opening, which more closely resembles the original airplane, follow these steps: Carefully peel up the black rubber coaming, and set it aside. Cement 3/32-inch balsa to fill in the corners of the cockpit opening. Make a cardstock template of a nice rounded oval opening, and trace it onto the balsa fillets you just installed. Carefully carve and sand to shape, and prime and paint to match. Don't worry about the coaming; that will be addressed later, after the plane has been clear-coated.

After the camouflage scheme has been completed, the remaining markings and insignias can be applied or painted. Most Nieuport 28s—and, indeed, most Nieuports—had roundels painted on the bottom of the upper wings, so I painted these using more craft paint and paint masks made from masking tape. The Hat in Ring insignia looks best if you remove the clear material from the interior of the insignia and cut close to the outside to avoid any "flash." Carefully apply this, working from top to bottom on the fuselage. Using a little bit of white paint, correct the hat brim, which should be in front of the red ring on the forward side. I made my numeral "14" out of white and black adhesive-backed covering. The tail numerals were cut apart and rearranged to give a different serial number. Peeling off the "2" on the bottom of the lower wing, I painted a "4" next to the "1," which I left in place—yielding a dark blue "14."

Here, you see the new shock-absorbing axle wire placed above the stick axle, which will be cut away.

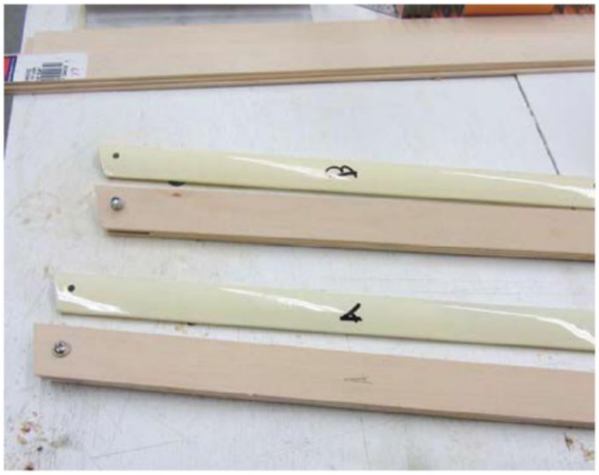
Here is the center attachment (pivot points) for the new shock-absorbing axles.

SUSPENSION

The landing-gear struts provided with the kit will certainly do the job, and the wheels are finished with the colorful ball-and-star hubs. I have a rather bumpy grass strip at my flying club, however, and a bit of shock absorbency is not a bad thing. To do this, simply slot the strut fairings to create a rebound slot. Fit a new axle of 3/16-inch music wire through the slots, making sure that it lines up parallel to the spreader bar and fairing. Remove the fairings and set aside, and using a cutoff wheel or hacksaw to remove the piece of wire that simulates the rigging wires and discard; also cut off the original axles that are extensions of the forward struts. Bend up a pair of brass tangs that fit over the spreader bar, and leave enough of a tab to accept a bolt and nut. Center them on the spreader bar, and solder in place. Drill a hole in each tab for the bolts. Cut two identical sections of 3/16-inch music wire to serve as the axles. Crimp the end of a piece of brass tube that fits over the end of the music wire, and solder in place; drill each end of these tabs for the bolt. Secure the axles to their tangs on the spreader using a bolt, washers, and a locknut. Make sure that each axle can move freely but snugly in the rebound slots. Temporarily set it up with rubber bands, and install the wheels using two collars per axle.

Use the stock interplane struts as a guide to drill the holes in the new basswood pieces needed for the new struts.

By laminating the three pieces of basswood together with the shorter piece in the center, slots are formed on each end of the new strut. The slots should be deep enough to fit the wings' mounting lugs.



Because the struts are different lengths, be sure to make them so that they are easy to identify.

INTERPLANE STRUTS

The model comes with aluminum streamline tube interplane struts, which are structurally fine and even look fine. They can be grained (see *MAN*, March 2015) to look like wood, which will greatly enhance their appearance, or you can make wooden replacement struts, which is actually fairly quick and easy. To do this, use strips of 3/32-inch-thick basswood, and laminate three pieces such that a notch is formed at either end to accept the mounting lugs in the wings. Use the original metal struts as drilling guides to drill the holes precisely where they need to be at either end of the struts. Make sure that the slot is deep enough to clear the tops of each wing-mounting lug; I used a compass for this task. When satisfied with the fit and alignment, glue up using Titebond and clamps; allow to dry thoroughly. Carve, sand, or grind to shape, then stain and clear-coat. The bindings can be simulated using short strips of Solartex. Using my inkjet printer, I made decals of the Newport logo and "Type 28" markings, which are placed between the top and middle bindings and at the bottoms, respectively.

I made these fittings more closely resemble the double-rigging wire setup of the original aircraft.

The aft fuselage mount tangs slip into a slot in the side of the fuselage and are secured with a screw on the inside. I annealed the part of the tang that is bent, forming a hook, and screwed it into place.

RIGGING FITTINGS

The kit comes with a complete rigging package, which is nice and can be rigged per the instructions if you wish. I chose to rig my model to resemble more closely the rigging of an actual Nieuport, with double flying wires and single landing wires. To do this, I bent and soldered new mounting tangs for the flying wires, which I then screwed into place on the inboard side of the mounting tangs on the bottom of the upper wing. The fuselage mounting tangs were a little trickier, as the aft ones had to be fit through a slot in the fuselage, bent through a lightening hole inside the cockpit floor, and turned back so that they formed a hook. Before bending them, I annealed this portion of the tang and drilled a hole such that, when the hook is formed, it can be screwed down to the plywood. I fit the forward one under the plastic flange that covers the forward face of the notch-out for the landing gear. I secured this with two screws on each tang. I used the aluminum tabs supplied with the kit to make attachment points for the X bracing between the interplane struts, as seen in profile.

Top: **The stock 3D-printed machine gun parts from IFlyTailies.** Above: **the assembled and painted guns look good and add a lot to the finished Nieuport.**

I start painting the Aces of Iron pilot bust with a base coat of chocolate brown, using craft paints.

Here, the pilot is almost done with an added overcoat of oil-paint glazes to achieve a realistic scale appearance. The goggles and scarf still need some work.

MACHINE GUNS AND PILOT

Maxford makes nice Vickers machine guns that will work just fine for this model. I chose to try a product from a new company: IFlyTailies, which offers 3D-printed Vickers machine guns. The guns come in three easy pieces to assemble along with a few cocking arms and levers, which require some care to separate from their substrate. These pieces can be assembled using CA, plastic cement, epoxy, or Gorilla glue. Be sure to paint the interior of the cooling jacket before cementing the muzzle-cap piece. The finished result is quite convincing. The only trick to working with 3D-printed parts is to trim away carefully the unwanted portions of material; this can be tricky sometimes if you're not familiar with how the finished part is supposed to look. Fortunately, there are graphic instructions on the company's website, which will clarify these details.

Aces of Iron Productions is the company that made the pilot, and I really do like its figures! I use them in most of my World War I aircraft. I only wish it made 1/8-scale pilots as I have to make these myself—which can be fun, but it's not a quick project! Anyway, comprehensive painting instructions for the lightweight plastic pilots it produces can be found on the company's website. I painted mine with a base coat of chocolate brown, then overcoated that with oil-paint glazes to achieve the desired effect.

The access panels are made out of sheet aluminum.

Here, you see the completed pilot, cockpit coaming, windshield, and headrest in place. Notice the new attachment brackets for the landing wires connected to the new wood cabane struts.

FINISHING DETAILS

Access panels were made out of sheet aluminum, and a venturi was made from a hardwood dowel chucked in a cordless drill, then filed and sanded to shape (Maxford provides one of these, but it is a bit too large to be scale). I used small fuel tubing and sheet leather to make my cockpit coaming, and sheet aluminum and acetate to make a windshield.

FLYING THE NIEUPORT 28

The plane has excellent ground-handling characteristics due to the large rudder and wide wheelbase. It flies in a scale fashion and presents no bad tendencies. It will turn easily using ailerons or rudder but looks best using both. It is a very stable model in flight. It is capable of all scale maneuvers, provided you exercise good throttle management. Landings are also enjoyable, and the suspension modification really helps take the bounce out of bumpy grass strip!

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Plans Directory

Top building projects from Model Airplane News*!*

For more than 87 years, *Model Airplane News* has been supplying model airplane builders and pilots with the best construction plans and articles for all types of RC aircraft. Ranging from vintage pattern ships and sport aerobatic planes to museum-scale classics and military warbirds, this year's Plans Directory truly has something for everyone! In this bonus plans guide, we have 140 of our all-time favorite build-it-yourself plans that you won't be able to find anywhere else. Each plan has a level of difficulty code (LD) to help you pick which airplane is right for you. **For a searchable database of more than 700 model builder's plans, go to the AirAgeStore.com and click "Plans."** Happy building!

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate
LD 3 = intermediate to advanced **LD 4** = advanced

ELECTRIC

Aeronca Champ

A semiscale slow flier, this Nick Ziroli design has a nostalgic appeal. Using stick-and-tissue construction, the Champ has excellent performance. It can be built with or without ailerons. WS: 35 in.; L: 21 in.; weight: 11 oz.; radio: 4 channels; 1 sheet; LD 2

X1100A; $14.95

ELECTRIC

Aeronca Chief

Designed by Pat Tritle, this model draws from old-time stick-and-tissue construction, and includes modern and efficient electric power to make a great lightweight scale flier. Four channels control gives it excellent performance. WS: 53.7 in.; L: 30.75 in.; power: Himax 2812-0850 brushless motor; 3 sheets; LD 2

K0308A; $24.95

ELECTRIC

Curtiss Jenny

Designed by Pat Tritle, this IMAA-legal sport-scale park flier is designed for low-cost brushless power. It uses "stick frame" construction with available plastic parts. WS: 60 in.; (top) area: 712 sq. in.; weight: 22.6 oz.; power: 1000Kv motor; radio: 4 channels; 3 sheets; LD 2

X0108A; $24.95

ELECTRIC

de Havilland Turbo Beaver

Designed by Pat Tritle, the Turbo Beaver is a traditional stick-built model and is intended as a park flier, though it is somewhat larger than the typical park plane. It has flaps and laser-cut wood parts, and formed plastic pieces are available from the author. WS: 60 in.; L: 41.5 in.; power: Suppo 2217/9 outrunner; 3 sheets; LD 2

X0915A; $27.95

ELECTRIC

Electric Curtiss P-40

Designed by Mark Rittinger, the P-40 Warhawk is an easy-to-build, high-performance sport-scale model of the classic WW II fighter. It uses a simple, built-up balsa and ply fuselage and a foam-core wing sheeted with balsa. No rudder is required, and to minimize drag, there isn't any landing gear. WS: 42 in.; power: geared Kyosho Magnetic Mayhem motor; radio: 3 channels; LD 2

X0603A; $19.95

ELECTRIC

Electric P-51 Mustang

Designed by Mark Rittinger, this semiscale Mustang is quick to build. The foam, balsa, and ply model flies well, thanks to its semisymmetrical wing and high power, and it excels at high-speed maneuvers. WS: 42 in.; L: 35 in.; power: 540-type; radio: 3 channels; 1 sheet; LD 2

X0902A; $19.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

ELECTRIC

Electro Hots

This newest rendition of the famous Hots design family takes lightweight construction to the limit. Using traditional balsa, plywood, and light ply, Steven Santich, the son of the designer of the original Hots, has produced a modern 3D flying machine that has single-digit wing loading! Ideal for the intermediate to advanced builder/flier. WS: 52 in.; L: 57 in.; power: 25-size brushless outrunner; radio: 4 channels; 2 sheets; LD 2 **X0710A; $21.95**

ELECTRIC

F6F Hellcat

Designed by Jim Ryan, this electric Hellcat is a Speed 400-powered sport-scale model that's easy to build and fly. The wings are sheeted foam, and the rest of the aircraft is traditional balsa-and-ply construction. WS: 30 in.; 1 sheet; LD 2

X07971; $14.95

ELECTRIC

F8F Bearcat

This Speed 400 model was CAD-designed by Jim Ryan and features a thinned Clark-Y airfoil, foam-core wing, and simple balsa construction. It is true to scale and, at only 18 ounces, is remarkably aerobatic. WS: 30 in.; L: 22.25 in.; power: Speed 400; radio: 3 channels; 1 sheet; LD 3

X01991; $14.95

ELECTRIC

Fieseler Fi 156 Storch

Designed by Pat Tritle, this classic WW II observation and STOL aircraft is a great performer. It has lightweight balsa "stick and former" construction, and laser-cut parts are available from the author. It has functional flaps and scale construction and outline. WS: 55 in.; L: 37.5 in.; power: 2217/9T outrunner; 3 sheets; LD 2

X0216A; $27.95

ELECTRIC

Fleet Model-2 Biplane

Designed by Pat Tritle, this 1/8-scale, 4-channel classic from the Golden Age of Aviation uses stick-and-tissue balsa-and-light-ply construction and is very scale in outline. It includes the airfoil-shaped horizontal stabilizer, and the plans show the standard tail outline but the model can be easily modified to produce other variants. WS: 42 in.; L: 32 in.; weight 18 oz.; power: Park 400; 2 sheets; LD 2

X0911A; $21.95

ELECTRIC

FlyBaby Bipe

Designed by Pat Tritle, the FlyBaby bipe is a lightweight yet strong park flier biplane. It features traditional stick-and-former construction with egg-crate wing structures. A one-piece design with the wings glued and rigged into place to save weight, this compact model fits easily into any car. WS: 33 in.; L: 30 in.; engine: 370 brushless; radio: 4 channels; 3 sheets; LD 2

X0413A; $24.95

ELECTRIC

Focke-Wulf FW 190

Designed by Mark Rittinger, the FW 190 has a wood fuselage and a sheeted foam-core wing. The model is one piece, and the wing is not removable. Balsa and foam blocks give the fuselage its distinctive shape. No landing gear is used, and the model is designed to be hand-launched. WS: 42 in.; L: 36 3/8 in.; power: electric; 1 sheet; LD 2

X0606A; $19.95

ELECTRIC

Fokker Dr.I Triplane

Designed by Pat Tritle, this electric Fokker Dr.I Triplane is a stable but aerobatic park flier that's suitable for flying in big indoor areas and outdoors. Construction is traditional stick and tissue. A laser-cut short kit is available from the author. WS: 25.5 in.; L: 20.75 in.; power: GWS IPS geared motor; radio: 3 channels; 1 sheet; LD 2

K0106; $19.95

ELECTRIC

Hawker Hurricane

Designed by Mark Rittinger, this Hawker Hurricane is a great addition to anyone's warbird squadron. It can be built with either a built-up wood wing or with foam cores. Both are shown on the plans. WS: 42 in.; L: 33.5 in.; power: 480 geared brushless motor; 1 sheet; LD 2

X0308A; $14.95

To order: Visit AirAgeStore.com or call 888-235-2021

ELECTRIC

Ingram Foster Pusher Biplane

Designed by Pat Tritle, this pusher biplane has a beautiful scalelike appearance, and uses toothpicks and bamboo skewers in its construction. The tail booms are made out of carbon-fiber tubes, and the fuselage frames are basswood. WS: 43 1/3 in.; L: 43 1/8 in.; power: geared 6V Speed 400; 1 sheet; LD 3

X0205A; $19.95

ELECTRIC

KI-61 Tony

Designed by Mark Rittinger, the KI-61 Tony is an easy-to-build balsa model with a foam-core wing and minimal parts count. It's designed specifically around the author's standard Magnetic Mayhem/Master Airscrew gearbox power system; other power systems can be used but aren't shown on the plans. WS: 42 in.; weight: 45 oz.; power: geared 550 to 600 electric motor; 1 sheet; LD 2

X1203A; $19.95

ELECTRIC

L-19 Glowdog

Designed by Keith Sparks, the L-19 Glowdog is a sport-scale Cessna observation plane that is not only a nice, easy-to-fly park flier but also a great night flier. Constructed of thin, lightweight Depron foam sheet material and light ply, the airplane is translucent and designed to light up. Formed plastic cowl and wingtips are available. WS: 72 in.; L: 50 in.; power: 280-size outrunner; radio: 4 channels; 2 sheets; LD 2 **X0410A; $21.95**

ELECTRIC

Lowers-Minges LM-1

Designed by Mark Rittinger, the Lowers-Minges LM-1 racer is of traditional balsa and lite-ply construction and features a foam-core wing. It is easy to build but demanding to fly, and is not intended for novice builders or pilots. It designed around the E-flite Power 25 brushless motor and power system. WS: 37 in.; L: 40 in.; power: 25-size brushless motor; 1 sheet; LD 2

X0116A; $16.95

ELECTRIC

Messerschmitt Bf-109E

Designed by Mark Rittinger, the Bf-109E plan also shows details for the Bf-109K, Avia S199, and Hispano Ha-112 variants. The model is a one-piece design and has a true scale outline. Uses balsa, light ply, and foam-core wing construction. A built-up wooden wing is also shown. WS: 42 in.; L: 37 1/8 in.; power: Kyosho reverse-wind motor; radio: 3 channels; 1 sheet; LD 2

X0605A; $19.95

ELECTRIC

Micro Tommy

The Thomas Morse Scout (Micro Tommy) designed by Richard Dery is a park/indoor flier designed around Depron foam sheet, micro RC equipment, and spare parts available from micro RC planes. It uses some balsa and easy cut-and-fold foam sheet construction. WS: 14.5 in.; L: 10.5 in.; power: micro electric motor; 1 sheet; LD 2

X1112A; $14.95

ELECTRIC

Min-E Taurus

Designed by Mark Rittinger, this is an electric-powered reduced version of the classic 1960s' Ed Kazmirski Taurus. It uses traditional balsa construction and a foam wing available from flyingfoam.com. It's easy to build, has excellent performance, and uses inexpensive power systems and radio gear. WS: 32 1/2 in.; L: 25.5 in.; power: 100 to 150 watts; 1 sheet; LD 2

M0312A; $14.95

ELECTRIC

Mini Me 262A-21

Designed by Mark Rittinger, this semiscale balsa-and-ply twin is quick to build and great fun in the air. WS: 38 in.; L: 28.5 in.; power: two Speed 400S; radio: 3 channels; 1 sheet; LD 2

X1001a; $19.95

ELECTRIC

Monocoupe

Designed by Richard Dery, this lightly loaded, 4-channel sport-scale classic monoplane is easy to build and makes for a great calm-weather flier. It is very scale in outline and has plenty of power for its size. It is modeled after the full-size plane in the Old Rhinebeck Aerodrome museum. WS: 48 in.; L: 32.5 in.; power: Park 450 BL; 2 sheets; LD 2

X0411A; $21.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

ELECTRIC

Nieuport 12

This Martin Irvine design is a two-piece WW I biplane built out of balsa, ply, and spruce. Construction is light and strong with some laminated parts. Recommended for experienced builders. WS: 68 in.; L: 54 in.; power: 500W electric or .60 to .80 four-stroke; radio: 4 channels; 1 sheet; LD 3

X04991; $14.95

ELECTRIC

Osprey GP5 Racer

Designed by Mark Rittinger, the Osprey GP5 is a sleek Super Sport Class Reno Racer design using traditional balsa, light ply construction, and foam-core wing design. The model features flaps and retracts and is intended for experienced pilots and advanced builders. WS: 44 in.; L: 46 in.; engine: 600+-watt brushless; radio: 6 channels; 1 sheet; LD 2

X1113A; $14.95

ELECTRIC

Pilatus PC-6

Designed by Jim Ryan, this Turbo-Porter features simple stick-balsa-ply construction. It's an agile yet docile indoor flier with predictable turning for small indoor venues. It has excellent ground handling for touch-and-gos. WS: 36 in.; L: 24 in.; motor: AstroFlight Firefly; radio: 3 channels; 1 sheet; LD 2

K1104A; $14.95

ELECTRIC

Pilatus Porter PC-6

Designed by Alex Samour, this sport-scale STOL aircraft has a composite wing with a traditional balsa box fuselage. The assembly process is simple, and the model can be covered with MonoKote. The Porter has good manners and is an excellent first tail-dragger. WS: 50 in.; L: 35.5 in.; weight: 51 oz.; wing loading: 24.7 oz./sq. ft.; power: .15 glow or 10-size brushless electric; radio: 4 channels; 3 sheets; LD 3 **X1115A; $29.95**

ELECTRIC

Piper PA-18 Super Cub

Designed by Pat Tritle, this impressive super-scale bush-plane classic uses traditional balsa construction and is easy to build and fly. Laser-cut parts and plastic parts are available from the author at patscustom-models.com. WS: 60 in.; L: 38.3 in.; engine: 950Kv; radio: 5 channels; 3 sheets; LD 3

X0114A; $24.95

ELECTRIC

Pitts Model-14

Designed by Pat Tritle, this model uses traditional stick-and-former construction with a little foam thrown in for good measure, and it's covered with lightweight iron-on film. The model is easy to fly and requires only 3 channels. Ailerons could be added, but details are not shown on the plans. WS: 30 in.; weight: 15.9 oz.; radio: 3 channels; power: geared speed 280 motor; radio: 3 channels; 2 sheets; LD 2

X0706A; $21.95

ELECTRIC

Playboy Senior 225

Designed by Bob Aberle, this indoor-electric old-timer is built with basic construction techniques and can fly for seven minutes on one charge of a 340mAh LiPo. WS: 42 in.; L: 25 in.; wing area: 225 sq. in.; motor: GWS LPS RLC-A geared 4:1; 1 sheet; LD 2

L0604A; $12.95

ELECTRIC

Shoestring

Designed by Pat Tritle, this all-sheet-balsa model is intended to be built and flown by modelers with intermediate skills. It is very stable, reasonably fast, and a joy to fly. WS: 30.5 in.; L: 28.5 in.; weight: 16 to 18 oz.; radio: 3 channels; power: 6V speed 400 motor; 1 sheet; LD 2

X05991; $12.95

ELECTRIC

Sky Skooter

Designed by Clark Salisbury, the Sky Skooter is a "what-if scale" model of a high-performance civilian, family mover, sport aircraft. It uses traditional wood construction, and vacuum-formed cabin window parts are available from the author. WS: 52 in.; L: 39 in.; power: 25 brushless motor; 1 sheet; LD 2

X0614A; $19.95

To order: Visit AirAgeStore.com or call 888-235-2021

ELECTRIC

Speed 400 Me-410A-1

Designed by Felipe Rabat, the Me-410 is an easy-to-build, electric-powered twin that captures the character of the full-size 1943 Luftwaffe Schnellbomber (fast bomber). The model uses standard balsa-and-ply construction with engine nacelles formed from white foam attached to wood profiles. WS: 39.5 in.; power: two Speed 400S; radio: 3 channels (rudder optional); 1 sheet; LD 2

K0908A; $14.95

ELECTRIC

Spitfire Mk 1

Designed by Mark Rittinger, this Spitfire is a great addition to anyone's warbird squadron. It has a built-up fuselage and sheeted wing that's surprisingly straightforward. WS: 42 in.; L: 34.75 in.; motor: 200+-watt brushless outrunner; radio: 3 channels; 1 sheet; LD 2

X1008A; $14.95

ELECTRIC

Standard J-1 Biplane

Designed by master builder Pat Tritle, this 1/9-scale barnstormer is IMAA-legal. It uses traditional stick-and-former construction with laminated outlines for wingtips, rudder, stabilizer, and elevators. Plastic parts are available. WS: 60 in.; power: brushless outrunner; radio: 4 channels; 3 sheets; LD 2

K1108A; $24.95

ELECTRIC

Tipsy S2

Designed by Dennis Sumner, the Tipsy S2 is a great-flying sport-scale design using traditional balsa-and-ply construction and a modern electric-power system. It features an elliptical wing and tail surface design. Its light wing loading makes this a great-flying airplane, and it would make a great first-scale project. WS: 50 in.; L: 36 in.; power: electric 480 class outrunner; radio: 4 channels; 2 sheets; LD 2 **K0715A; $23.95**

ELECTRIC

Westland Whirlwind

Designed by Mark Rittinger, this semiscale model is built from all balsa and has a low parts count. A low wing loading makes this a great-flying model. WS: 41.75 in.; L: 26.5 in.; power: two Speed 400S; radio: 3 channels; 1 sheet; LD 2

X0302A; $19.95

SCALE

A6M2 Zero

Designed by Jim Ryan, the Zero is fun to fly. With a stock Speed 400 motor or with brushless power, it can easily be hand-launched, and it's fast and aerobatic. WS: 32 in.; L: 23.5 in.; power: Speed 400; radio: 3 channels; 2 sheets; LD 2

X1105A; $19.95

SCALE

A6M3 Japanese Zero

Designed by Mark Rittinger, the Zero is an electric-powered fighter with traditional wood construction and foam wing cores. It features a quick wing release for fast battery changes. Rudder and retracts are optional. WS: 49 in.; L: 38 3/4 in.; power: E-flite Power 25; 1 sheet; LD 2

X0314A; $19.95

SCALE

Airco DH2

Designed by David Johnson, the DH2 is a unique, nicely detailed WW I aircraft that will draw attention wherever you fly it. It is a traditional stick-and-tissue model, and it features functional wing rigging and a pull-pull control system. WS: 32 in.; L: 25.5 in.; power: geared Speed 280; 1 sheet; LD 2

X0705A; $14.95

SCALE

Bellanca Cruisemaster

Designed by Dennis Sumner, the Bellanca Cruisemaster is an electric-powered classic civilian plane not often seen at the flying field. The model has a simplified design and features conventional balsa-and-plywood construction. It has an engine cowl that's attached with magnets, and it features easy-to-install electric retracts. WS: 54 in.; L: 37.25 in.; power: 430-watt brushless motor; 1 sheet; LD 2

X0115A; $16.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

SCALE

Britten-Norman BN2T-4S Defender

Designed by Rich Uravitch, the Britten-Norman Defender 2000 is a semiscale twin design that is very easy to build and fly. Traditional balsa-and-ply construction is used, and flaps are optional. Formed plastic parts are available from the author. WS: 70 in.; L: 52.7 in.; power: 2 brushless motors; 2 sheets; LD 2

X0708A; $21.95

SCALE

Canadair CL-215

A sport-scale model of the famous twin-engine, amphibian, fire-fighting water-bomber. Steve Gray design uses spruce, balsa, and ply as its principal materials. WS: 76 in.; L: 55 in.; area: 791 sq. in.; engine: two .25; radio: 5 channels; 1 sheet; LD 4

X05801; $14.95

SCALE

Cessna 310B Songbird

Designed by expert model builder and flier Rich Uravitch, the Cessna 310B Songbird is a straightforward build and a stable flier. It features built-up balsa-and-light-ply construction, and laser-cut parts and formed plastic parts are available. A perfect first twin. WS: 52.8 in.; L: 31.75 in.; power: 2 Jacker A20 brushless; 2 sheets; LD 2

X08091; $21.95

SCALE

DH 90 Dragonfly

This classic 1935 twin-engine biplane is designed and built by Ivan Pettigrew. The 1/7-scale model uses traditional built-up balsa-and-ply construction and is an advanced scale design requiring intermediate to expert building experience. WS: 74 in.; L: 54 in.; power: 2 brushless 450 motors; 2 sheets; LD 2

X1114A; $23.95

SCALE

Douglas A-26 Invader

Designed by Mark Rittinger, this Speed 400-size A-26 Invader is a great-flying twin. It is easy to build and has traditional balsa-and-plywood construction. The model is a one-piece design, and the wing panels are completely sheeted. Good slow-speed performance and ideal for inexpensive electric Speed-400 brushed can motors. WS: 42 in.; L: 30.7 in.; power: two Speed 400 motors; 1 sheet; LD 2

X1208A; $14.95

SCALE

Douglas SBD Dauntless

Designed by Mark Rittinger, the Douglas SBD Dauntless torpedo bomber is the newest addition to his "warbird series" of electric-powered military airplanes. It has a built-up wooden fuselage and foam-core wings. WS: 42 in.; L: 32 in.; power: 500-size electric; radio: 3 channels; 1 sheet; LD 2

X0306A; $19.95

SCALE

DR-109

This Rich Uravitch design uses a fully symmetrical airfoil. Rich offers a parts package, formed aluminum gear, and a fiberglass cowl; Hobby Hangar offers laser-cut parts. WS: 54.5 in.; L: 49 in.; wing area: 552 sq. in.; weight: 78 to 88 oz.; engine: .40 to .50 two-stroke or .48 to .70 four-stroke; radio: 4 channels; 2 sheets; LD 2

X10991; $19.95

SCALE

Evans Volsplane

Designed by Pat Tritle, this easy-to-build park flier has built-up lightweight construction and features scale all-flying tail surfaces just like the real thing. Laser-cut parts available from author. WS: 36 in.; L: 28 in.; power: Maxx Products EPU-4 Gear Drive; 2 sheets; LD 2

X0714A; $23.95

SCALE

Extra 3.25

Designed by Rich Uravitch, this model has balsa-and-ply construction, and Rich offers formed-plastic cowl, wheel pants, and canopy. Intermediate skills required. WS: 47.25 in.; L: 36.5 in.; engine: .19 to .28 two-stroke; 1 sheet; LD 2

X01931; $14.95

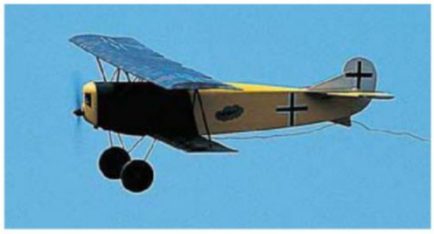
To order: Visit AirAgeStore.com or call 888-235-2021

SCALE

Fieseler Storch

The Fieseler Storch was a German Luftwaffe STOL aircraft that was used extensively throughout WW II. Rob Caso's 1/12-scale model is highly detailed and features functional shock-absorbing landing gear and leading-edge wing slats for amazing slow flight. It uses former-and-stringer, balsa-and-ply construction throughout. WS: 46 in.; L: 31.5 in.; power: BP Hobbies A2217-9 brushless; radio: 6 channels; 1 sheet; LD 2 **K0510A; $14.95**

SCALE



Fokker D-VII

Designed by David Johnson, this small Fokker D-VII is big on performance. Designed around a .25 two-stroke engine and a C.B. Tatone in-cowl muffler, the model is built out of balsa for quick and easy construction. It's very maneuverable yet stable, and makes a great combat model. WS: 43.25 in.; L: 32.5 in.; engine: .25 two-stroke; radio: 4 channels; 1 sheet; LD 2
X0204A; $14.95

SCALE

Fokker D-VII

This WW I German fighter is easy to build and big enough to win at contests. The relatively simple design by Rich Uravitch is built out of balsa and ply using traditional methods. WS: 49 in.; L: 41 in.; area: 712 sq. in.; engine: .60 four-stroke; radio: 4 channels; 1 sheet; LD 2
X04852; $19.95

SCALE

Ford Trimotor

The Ford Trimotor designed by Pat Tritle uses lightweight string-and-former construction, and there is a laser-cut wood parts package available from the author. It is powered by three brushless outrunner motors and a single 2S LiPo pack. It is intended for intermediate builders and fliers. WS: 46.7 in.; L: 31.75 in.; power: 3x250; 3 sheets; LD2
X0912A; $24.95

SCALE

Gee Bee Model-A Biplane

Designed by Gee Bee expert Henry Haffke, this 1/6-scale model is a beautiful reproduction of the Model-A biplane, first built by the Granville brothers. Made in the traditional way, out of balsa and plywood, the model is simple and strong. WS: 60 in.; L: 40.75 in.; engine: .60; 2 sheets; LD 2
X0604A; $24.95

SCALE

Gee Bee Model-Y Senior Sportster

CAD designed by Charlie Pipes, the Gee Bee Model-Y Super Sportster is a good-flying electric-powered sport-scale design. Using traditional balsa, ply, and lite-ply construction, there are laser-cut parts available. WS: 45 in.; L: 27 in.; area: 270 sq. in.; power: E-flite Power 10 Outrunner; 2 sheets; LD 2
X0409A; $21.95

SCALE

Grumman G-164 Ag Cat

Designed by Pat Tritle, the Grumman G-164 Ag Cat is a 1/12-scale crop-duster biplane that's built light and strong. It is ideal for smaller flying areas and is very stable and easy to fly. A plastic and laser-cut wood parts kit is also available from the author at patscustom-models.com. WS: 42.3 in.; L: 27.4 in.; engine: 400-450 brushless; 3 sheets; LD 2
X0513A; $24.95

SCALE

Howard Ike

This is an RC scale model of Ben Howard's famous scale plane. The fuselage is a basic box "fleshed out" with formers and stringers; the design by Henry Haffke uses balsa, ply, and hardwood. WS: 56 in.; L: 45 in.; engine: .40; radio: 4 channels; 2 sheets; LD 2
X04791; $19.95

SCALE

Lear Fan

Designed by John Valentine, the Lear Fan is a sleek, attractive, sport-scale, V-tail aircraft. The all-wood model uses lock-tab construction, and the author has laser-cut parts available to speed construction. WS: 78 in.; L: 71 7/8 in.; weight: 10 lb. 8 oz.; engine: .45 to .60 two-stroke; radio: 6 channels; 4 sheets; LD 2
X0806A; $29.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

SCALE

Lockheed YO-3A Quiet Star

Designed by Keith Sparks, this military powered glider is traditional balsa-and-ply construction, and the author has formed plastic parts and a 6-blade prop available. WS: 74 in.; L: 42 in.; power: electric outrunner; 1 sheet; LD 2

X0408A; $14.95

SCALE

Macchi MC.200 Saetta

Designed by master draftsman and expert scale modeler Guiliano Riamondi, the Macchi MC. 200 Saetta is a precision-scale, balsa-and-plywood model capable of world-class competition. All scale fittings, cockpit interior, control surfaces, and a dummy radial engine are shown on these amazingly detailed plans. WS: 79.9 in.; L: 60.5 in.; weight: 13.3 lb.; scale: 1/5.2; engine: 1.08 two-stroke; radio: 6 channels; 9 sheets; LD 4 **X12961; $49.95**

SCALE

Martin PBM Mariner

Designed by Keith Sparks, this flying boat's fuselage is made with cross-sections of blue foam that are sanded to shape, and the wings have foam cores. The model is covered with fiberglass cloth and resin. The plans show all the details and the full-size cross-sections for the fuselage. WS: 78 in.; L: 75 in.; power: two .52 four-stroke or two .40 two-stroke; 3 sheets; LD 3

X1103A; $24.95

SCALE

Messerschmitt ME 163B-1a

This exciting model of the first WW II rocket-powered plane is a true masterpiece. Colin Moss's tailless design features leading-edge slots and great maneuverability. Constructed out of balsa and ply. WS: 59 in.; L: 38 in.; radio: 5 channels; 2 sheets; LD 2

X11761; $19.95

SCALE

One Design .40

Designed by Rich Uravitch, this conventionally built, all-wood design would make a great entry for Minimac and/or sport-scale competition. WS: 47.2 in.; L: 44 in.; power: .40 two-stroke or .70 four-stroke; 2 sheets; LD 2

X04980; $14.95

SCALE

OV-1 Mohawk

Designed by Keith Sparks, the OV-1 Mohawk is a 1/6-scale model of the U.S. Army aircraft. It features traditional planked-wood construction, and the author offers a formed canopy and nacelles. Because it's intended for electric power, it is an ideal first twin project. WS: 59 in.; L: 47 in.; power: Speed 500 brushed or brushless motor; 2 sheets; LD 2

X1206A; $21.95

SCALE

OV-10 Bronco

This is a simple, scale, small-displacement model that makes a perfect first twin-engine project. It's easy to construct; formed-plastic parts are available from designer Rich Uravitch. WS: 52 in.; L: 52 in.; power: two .20 to .25 engines or .05 to .15 motors; radio: 4 channels; LD 2

X11951; $19.95

SCALE

OV-10 Bronco

Designed by Keith Sparks, this model would be an ideal first scratch-built project. It is completely built up, can use a variety of power systems and battery packs, and offers gentle to lively performance. A laser-cut short kit, plastic parts and scale details are available. WS: 47 in.; wing area: 403 sq. in.; power: two Speed 300 or 400 motors; 1 sheet; LD 1

X0106A; $14.95

SCALE

P-51 Reno Racer

This aircraft is a perfect companion to the T-6 (X04821) and a great project for simplified scale fun. Designed by Rich Uravitch, it uses the author's same easy-to-build all-balsa construction and is intended for a .15 two-stroke glow engine. Ideal for use as a one-design club racer for hot weekend scale fun. WS: 43.5 in.; L: 32.5 in.; engine: .15 to .19; radio: 4 channels; 1 sheet; LD 2

X04832; $19.95

To order: Visit AirAgeStore.com or call 888-235-2021

SCALE

Precious Metal P-51 Reno Racer

Designed by Mark Rittinger, the Precious Metal P-51 is the latest in his Reno racing series. It uses balsa-and-ply construction for the fuselage, and the wing has foam-core construction sheeted with balsa. Designed to use the Himax 3516CR contra-rotating twin-prop drive system, it is a project for the advanced pilot and experienced builder. WS: 45 in.; L: 45.5 in.; engine: 600-watt brushless; radio: 4 channels; 1 sheet; LD 3 **X1213A; $14.95**

SCALE

PS-36 Seaplane

Designed by Rich Uravitch this modern electric-powered aquatic flier is based the classic Scott Hartmann "Pondside" flying boat design. Featuring easy-to-build construction with traditional balsa and lite-ply parts, the PS-36 also has a laser-cut parts kit available to speed construction. WS: 35.9 in.; L: 27.9 in.; power: 135W brushless; 1 sheet; LD2

X0112A; $14.95

SCALE

RAF S.E.5a

Rich Uravitch's design will let you enjoy the fun of a biplane without the pain of intricate building. For intermediate builders, this model is built up out of balsa and ply. WS: 50 in.; L: 40 in.; area: 800 sq. in.; engine: .60 four-stroke; radio: 4 channels; 1 sheet; LD 2

X03852; $19.95

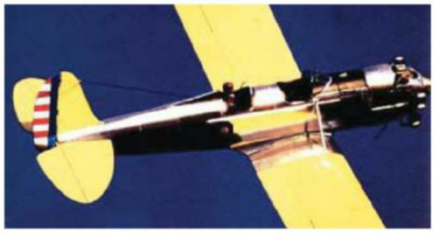
SCALE

Republic P-47 Thunderbolt

This "penny-pinching" warbird will be a neat addition to your sport-scale hangar. The built-up Rich Uravitch design is easy to build and fly. WS: 40 in.; L: 29 in.; engine: .15 to .19; radio: 4 channels; 1 sheet; LD 2

X06843; $19.95

SCALE



Ryan ST

This balsa-and-ply Henry Haffke plan shows details for several versions and includes details to build the scale Kinner radial engine. WS: 66 in.; L: 48.75 in.; engine: .40 to .60 two-stroke; radio: 4 channels; 1 sheet; LD 2

X11991; $19.95

SCALE

S.E.5a WW I Scout

Designed by Pat Tritle, the R.A.F. SE5a Scout is the perfect first WW I biplane for someone who wants to build a park flier. Construction is CAD designed using a lightweight stick-and-former layout. Laser-cut wood parts are available from the author. WS: 36 in.; L: 28 in.; power: E-flite Power 480 brushless motor; 3 sheets; LD 2

X1114A; $27.95

SCALE

Shockwave Reno Racer

Designed by Mark Rittinger, the Shockwave is a model of the full-size unlimited Reno Racer that's still in the planning and construction stages. It is intended for experienced builders and pilots who enjoy fast planes. It flies great but does require scratch-building experience. WS: 42.75 in.; L: 44 in.; power: E-flite Power 32 outrunner; 1 sheet; LD 2

X0115A; $19.95

SCALE

Sopwith Camel

Designed by John Tanzer, this Sopwith Camel uses traditional balsa-and-plywood construction, and several balsa parts are made from three-layer laminations. Flight with a Saito .30 engine turning an 11x4 APC prop is very spirited. The Camel can be converted to electric very easily. WS: 38 in.; L: 25 in.; power: .30 four-stroke; 1 sheet; LD 2

X0403; $14.95

SCALE

Stinson Reliant SR-10

Designed by Pat Tritle, the 1/9-scale Stinson Reliant is rather large for a park flier; however, due to its effective scale flaps, it can be flown in relatively small areas. Built primarily using balsa and light ply, it is a complex model. The design has been simplified without losing its distinct scale outline. WS: 55.8 in.; L: 36.5 in.; power: ThunderTigre .10 brushless motor; 3 sheets; LD 2

X0514A; $27.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

SCALE

Stinson Reliant SR-5E

Designed by Ron Peterka, the Stinson Reliant SR-5E is 1/5 scale and intended for serious scale competition. It is completely detailed inside and out, and matches Wylam 3-view drawings. Powered by a Zenoah G-26 gas engine, the SR-5E features conventional balsa, light ply, and plywood construction. The plans are very detailed. WS: 98 in.; L: 45.5 in.; engine: G-26 gas; 3 sheets; LD 3

X0913A; $24.95

SCALE

T-28 Trojan

Designed by Rich Uravitch, the T-28 Trojan uses traditional balsa-and-ply construction and can be outfitted with fixed or retractable landing gear; a short wood kit and a plastic parts kit are available for the model. WS: 48 in.; L: 36 in.; power: .25 glow or brushless motor; 2 sheets; LD 2

X0206A; $21.95

SCALE

T-6 Texan

An easily constructed, performance-packed sport racer. The all-balsa, built-up design by Rich Uravitch uses foam for its turtle deck. WS: 44 in.; L: 31 in.; engine: .15 to .19; radio: 4 channels; 1 sheet; LD 2

X04821; $14.95

SCALE

Time Flies

This Henry Haffke design has superb flight characteristics and features a planked, sheeted fuselage and wings. WS: 72 in.; L: 51 in.; area: 900 sq. in.; engine: .90 to 1.20; radio: 4 to 6 channels; 2 sheets; LD 3

X08851; $29.95

SCALE

Westland Wyvern S.4

This Vance Mosher design is an unusual scale project for someone interested in a smaller model. The wing is of conventional balsa-and-ply construction. The plan set includes scale 3-view drawings. WS: 36 in.; L: 34 in.; engine: .15 two-stroke; 3 sheets; LD 3

X0600a; $24.95

GIANT SCALE

1/4-scale Bucker Jungmeister

This 1/4-scale design has the same all-wood construction as the larger model designed by Gary Allen, and laser-cut wooden parts and engine cowl are available from Arizona Model Aircrafters. WS: 65 in.; engine: 1.20 four-stroke or a G-23; 4 sheets; LD 3

X0300b; $21.95

GIANT SCALE

1/4-scale Fokker E.V.

Designed by David Johnson, the 1/4-scale Fokker E.V. parasol fighter is easy to build and flies like an advanced trainer. Traditional balsa, spruce, and plywood construction is used throughout, and the wing is fully sheeted. Pull-pull cables are used for all control surfaces. WS: 84 in.; L: 51 3/8 in.; power: G-38 gas; radio: 4 channels; 2 sheets; LD 2

X0305A; $24.95

GIANT SCALE

Big Hots

This Dan Santich design is one of the best-flying giant models of all time. Simple construction methods on two huge full-size drawings make building quick and easy. WS: 91 in.; L: 78 in.; area: 1,800 sq. in.; engine: 1.5; radio: 4 channels; 3 sheets; LD 2

X11861; $29.95

GIANT SCALE

Classic Sport Bipe

Designed by Gerald Garing, this lightly loaded, sport-scale Great Lakes look-alike is an ideal vintage biplane design that's extremely impressive when equipped with a smoke system and a scalelike paint scheme. Many have been modified and flown at the Old Rhinebeck Aerodrome during the WW I Jamboree. WS: 72 in.; L: 65 in.; area: 1,640 sq. in.; engine: 1.8; radio: 4 channels; 3 sheets; LD 3

X05891; $29.95

To order: Visit AirAgeStore.com or call 888-235-2021

GIANT SCALE

Cobra

Unprecedented giant-scale model of a famous racer. Twin gullwings on a Midget Mustang fuselage make this Dan Santich design a real flying machine. Built-up balsa, ply, and hardwood construction. WS: 76 in.; L: 65 in.; engine: 2ci+; radio: 4 channels; 3 sheets; LD 2

X03841; $34.95

GIANT SCALE

Convair CV-240/C-131 Samaritan Transport

Designed by Andy Anderson, the Convair CV-240/C-131 Samaritan is an excellent flying sport-scale twin designed around a pair of O.S. .32 two-strokes. It uses traditional balsa-and-light-ply construction and includes off-the-shelf retracts, struts, and flaps. WS: 82 in.; L: 65 in.; power: two .32 glow engines; 3 sheets; LD 2

X0808A; $24.95

GIANT SCALE

Fokker D-VII

This 1/4-scale Gary Allen design uses balsa-and-plywood construction and many standard hardware items. A SuperTigre 2500 glow engine is the standard powerplant, but a Zenoah G-38 or G-45 gasoline engine also works well. WS: 88 in.; L: 69.5 in.; radio: 4 channels; 4 sheets; LD 3

X02981; $29.95

GIANT SCALE

Fokker D-VIII

This classic 1/3-scale German WW I fighter is an ideal first giant model project, and it has scalelike construction using conventional materials. Bob Dunn directed this group effort by the Southern Tier Aero Radio Society club. The design can still be seen at vintage WW I fly-ins, and it was featured as a construction article in the Dick Phillips' Giant Steps book (no longer in print). WS: 98 in.; L: 66 in.; engine: 2.4; radio: 4 channels; 3 sheets; LD 2 **G00001; $29.95**

GIANT SCALE

Giant Peashooter

Designed by Henry Haffke, this all-wood, built-up sport plane has a scalelike appearance. The super-easy-to-build design has extremely docile flight characteristics. WS: 82 in.; L: 64 in.; area: 1,250.5 sq. in.; engine: .90 two-stroke or 1.20 four-stroke; 2 sheets; LD 2

X09951; $19.95

GIANT SCALE

Grumman Lynx

Designed by David Andersen, the Grumman Lynx is a 1/3-scale civilian general aviation aircraft designed for FAI scale competition. It has fixed gear and flaps, and several formed accessories are available. WS: 98 in.; L: 77 in.; power: GT-80cc; 5 sheets; LD 2

X0906A; $34.95

GIANT SCALE

Howard Ike Miss Chevrolet Racer

Designed by Henry "Mr. Gee Bee" Haffke, this 1/3-scale Miss Chevrolet is a great-flying, fairly-easy-to-build scale model. Using traditional balsa-and-plywood construction methods, the model can be powered by a glow or gas engine. A 26cc Zenoah engine powered the prototype. WS: 88 in.; L: 66.5 in.; engine: 26cc gas; 4 sheets; LD 2

X0313A; $29.95

GIANT SCALE

Knight Twister Imperial

A peerless, exciting-to-fly Golden Age classic in 1/3 scale, this Dan Santich design requires extensive building; the full-size parts are drawn on a separate sheet. WS: 70 in.; L: 62 in.; area: 1,505 sq. in.; engine: 2ci or larger; radio: 4 channels; 3 sheets; LD 3

X10851; $34.95

GIANT SCALE

Liberty Sport B

One of the best-flying biplanes, this advanced Roger Stern design spans nearly 8 feet and requires a gas engine. This model features built-up rib sections, detachable wing panels, and laminated wingtips. WS: 79 in.; area: 2,041 sq. in.; radio: 4 channels; 4 sheets; LD 4

X07861; $34.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

GIANT SCALE

Nifty 80

Designed by Gerry Yarrish, this is an easy-to-build, giant-scale budget trainer. WS: 80 in.; engine: G-23; 2 sheets; LD 2

X10932; $19.95

GIANT SCALE

Piper J-3 Cub

Designed by world-scale competitor Bob Nelitz, this impressive 1/3-scale Piper J-3 Cub set the standard for giant-scale competition for many years. It features true-to-scale construction and detailing, and it is accurate in both function and outline. Fuselage uses hardwood-dowel construction to replicate the full-size aircraft's welded tube structure. WS: 144 in.; L: 81 in.; engine: 2.4; radio: 4 channels; 2 sheets; LD 2 **G00005; $34.95**

GIANT SCALE

Prime Cut +20

Designed by Dick Sarpolus, this sport-flying giant scale design is easy to build and fly, has aerobatic performance, and can use a 4-channel radio and 40 to 50cc gas engine. Construction is basic, built-up balsa and plywood with plug-in wing panels on a strong aluminum tube spar/joiner. The canopy section is built as part of the fuselage. WS: 90 in.; L: 68 in.; weight: 14.5 lb.; power: 45cc gas engine; 3 sheets; LD 2 **X0611A; $24.95**

GIANT SCALE

Ryan STA

This design combines the style of Golden Age aircraft with modern-day aerobatic performance. Burnis Fields's 1986 1/4-scale plan is beautifully drawn and includes building illustrations. WS: 91 in.; L: 67.5 in.; area: 1,296.75 sq. in.; engine: 1.5; radio: 5 channels; 3 sheets; LD 4

X05861; $34.95

GIANT SCALE

S.E.5a WW I Scout

Designed by John Simmance, the S.E.5a is IMAA-legal and uses traditional balsa-and-plywood construction techniques. The highly detailed CAD plan of the airframe construction closely follows that of the full-scale WW I aircraft. With its level of detailing and precise assembly, this model is for the experienced builder who's looking for a great-flying scale biplane. WS: 71 in.; L: 56.5 in.; power: 1.20 to 1.80 four-stroke; radio: 4 channels; 6 sheets; LD 3

X0703A; $29.95

GIANT SCALE

SIAI Marchetti SF-260

This fast and maneuverable 1/4-scale modern fighter trainer is designed by David W. Goerne. The plan includes three large sheets, and cutaway and instrument-panel illustrations by master aviation artist Jim Newman. WS: 87 in.; L: 70.5 in.; engine: 2.6 to 3.4ci.; LD 3

X06931; $29.95

GIANT SCALE

Sopwith Baby

Designed by John Tanzer, this seldom-modeled WW I biplane is relatively easy to build and fly. The Baby uses built-up balsa-and-spruce construction. Flying wires are not required. Removable wood cabane struts, so wing alignment and model disassembly aren't complicated. Can also be flown off water with floats. WS: 77 in.; L: 50 in.; engine: 3.7ci; radio: 4 channels; 3 sheets; LD 3

X02991; $19.95

GIANT SCALE

Sopwith Camel

Designed by Gerry Yarrish, this 1/4-scale WW I biplane has the looks of the classic British dogfighter and the heart of a sport flier. It is CAD-designed, and laser-cut parts are available. Easy to build, the Camel has a one-piece top wing and plug-in lower wing panels. WS: 84 in.; L: 57 in.; power: Zenoah G-38; 4 sheets; LD 2

X1215A; $29.95

GIANT SCALE

The Albatross D.III

Designed by David Johnson, the 1/3-scale Albatross D.III is a great flying WW I biplane. It is scale in outline and can be built fully detailed for serious scale competition. It can also be a great sport flier as it has excellent flight characteristics. WS: 118 in.; L: 93.5 in.; power: 3.5 to 4ci two-stroke gas; radio: 4 channels; 5 sheets; LD 3

X1205A; $29.95

To order: Visit AirAgeStore.com or call 888-235-2021

GIANT SCALE

Ultra Hots

The Dan Santich-designed super-aerobatic Ultra Hots is stable in slow flight but is also exceptionally capable. It's for intermediate builders, but it will bring out the best in any aerobatic flier. WS: 81 in.; L: 64.5 in.; engine: 1.5 to 4ci; radio: 4 channels; 2 sheets; LD 2

X11901; $24.95

GIANT SCALE

Waco E

This Douglas Hobbs design duplicates the style and grace of the original. Its "cabin" retains the configuration of a biplane without the use of cabane struts. Structure is built up using conventional materials. WS: 72 in.; L: 56 in.; area: 1,147 sq. in.; engine: .90 four-stroke; radio: 4 channels; 2 sheets; LD 3

X06891; $29.95

GIANT SCALE

Westland Wyvern S4

Designed by David Wigley, this 1/5-scale model has custom shock-absorbing retracts and functional Fowler flaps. The power system consists of a BME 100cc twin-cylinder gas engine and a homemade contra-rotating propeller. The rear 3-blade prop is engine driven, while the front prop windmills. WS: 100 in.; L: 96 in.; engine: BME 100cc twin-cylinder; 4 sheets; LD 4

X0508A; $29.95

GIANT SCALE

Zlin 526 AS

Designed by Dick van Mourik, this aerobatic model uses traditional balsa-and-ply construction. The detailed plans show scale, homemade retracts. WS: 83 in.; L: 63 in.; engine: Laser 1.50; radio: 6 channels; 2 sheets; LD 3

X0102a; $21.95

JETS

Douglas F4D-1 Skyray

This precision, 1/7-scale model by Mark Frankel can be flown off grassy fields. Mixing radio with at least 7 channels is required. WS: 57.5 in.; L: 77.5 in.; engine: O.S. .91 fan unit: Dynamax; LD 3

X04931; $29.95

JETS

F/A-18 Hornet

Designed by Steve Shumate, this simple, lightweight, pusher-prop jet can duplicate the aerobatic routines flown by the Navy's famous Blue Angels. Its building materials (e.g., thin foam sheet and foam-safe CA) are inexpensive and readily available. WS: 28.4 in.; L: 41.7 in.; wing area: 254 sq. in.; weight: 15 to 18 oz.; power: GWS EPS-350C with C gearing; prop: GWS 8x6 Slow Flyer; radio: 6 channels w/ micro-receiver; 2 sheets; LD 2 **K0705A; $14.95**

JETS

F/A-22 Raptor

Designed by Steve Shumate, this semiscale pusher-prop design has thrust-vectoring capabilities for amazing maneuverability. Made from sheet foam, it is easy to build and fun to fly. Intermediate building and piloting skill required. WS: 26 in.; L: 36.2 in.; weight: 18 oz.; power: brushless outrunner; 2 sheets; LD 2

X1111A; $21.95

JETS

F-106 Delta Dart

Designed by Dan Savage, this EDF is sport scale but includes a fully cambered airfoil, reflexed training edge, and scale leading-edge droop. It features wood-and-light-ply construction throughout. It has excellent flight performance and very good slow-speed performance. A laser-cut short kit is available. WS: 28 in.; L: 49.5 in.; power: WeMoTec Minifan 480/Kyosho AP-29L; radio: 3 channels; 3 sheets; LD 2 **K1110A; $24.95**

JETS

F-4 Phantom II

Designed by Dan Savage, this electric ducted fan looks like a scale jet but flies like a sport model. It uses traditional balsa, ply, and light-ply construction and is intended for 90mm or 3.5-inch EDF fan units and 900- to 1500-watt power systems. If you can build a sport plane, you can build this F-4. It is intended for intermediate to expert pilots. WS: 50.5 in.; L: 33 5/8 in.; power: 90mm; 3 sheets; LD 2 **K0312; $24.95**

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

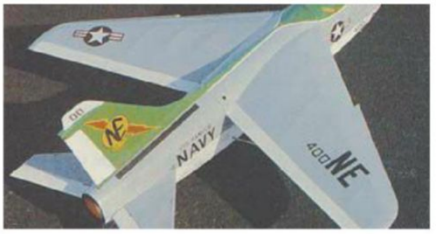
JETS

Foam F-14 Tomcat

Designed by Steve Shumate, this semiscale park flier F-14 Tomcat has excellent flying characteristics and looks remarkably realistic when airborne. It features a working variable-sweep wing, and simple foam-and-plywood construction. WS: 40.7 in.; L: 40 in.; power: geared electric pusher prop; 2 sheets; LD 2

X0506A; $19.95

JETS



LTV A-7 Corsair II

Rich Uravitch's 4-channel A-7 Corsair is an aerobatic, .25-powered semiscale "jet" without the complexity of a ducted fan. This eye-catching model can be built by anyone but requires at least intermediate flying skills. WS: 35.5 in.; L: 36.75 in.; engine: .19 to .28ci; 3 sheets; LD 2

X01951; $19.95

JETS

MicroWave

Designed by Rich Uravitch, this electric ducted fan design uses a recycled EDF power unit from a worn-out foamie jet. The plans include a long- and a short-wing version, so you can build a cruiser or an interceptor. Formed plastic parts and laser-cut wood parts are available. WS: 29 or 36 in.; L: 27.75 in.; power: 70mm EDF unit w/ brushless motor; radio: 3 channels; 2 sheets; LD 2

X0110; $24.95

JETS

MiG-17 Fresco

Designed by Jim Young, this electric MiG-17 is designed and built around the Great Planes 56mm Hyperflow EDF unit and is powered by an Ammo 24-45-3790 brushless motor. It features traditional built-up balsa-and-plywood construction, and laser-cut parts are available from the author. WS: 28 in.; L: 33 in.; power: 56mm GP Hyperflow unit; 1 sheet; LD 3

X0215A; $16.95

JETS

Mini Wave EDF

Designed by Rich Uravitch, this easy-to-build electric ducted fan is ultra-reliable and reaches speeds of 100mph. It uses traditional balsa, light-ply, and ply construction, and is covered with iron-on film. Vacuum-formed plastic and laser-cut wooden parts are available. WS: 48 1/4 in.; L: 47 in.; power: WeMoTec 90mm fan unit w/ Hacker B50 brushless motor; 2 sheets; LD 2

X0505A; $21.95

JETS

Sukhoi SU-37 Super Flanker Park Jet

Designed by Steve Shumate, this semiscale, easy-to-build, all-foam park jet is powered by two pusher-prop motors and includes functional three-axis, thrust-vectoring control. It is made using flat sheets of foam, and the plan shows all part templates and a detailed drawing of how the power system works. WS: 30 in.; L: 43.2 in.; power: two Park Jet motors with pusher props; 2 sheets; LD 2

K0708A; $21.95

JETS

T-50 Golden Eagle

Designed by Laurent Berlivet, this contemporary military jet trainer design is built using foam and wood, and the plans show all of the cross-sections to accurately cut the foam with a hot-wire cutter. The wing and tail are built from balsa and ply. WS: 27 in.; L: 33 in.; power: brushless inrunner; 2 sheets; LD 3

X0109A; $21.95

JETS

The Strike

The latest version of the popular Shrike designed by Joe Beshar. The Strike is powered by an electric ducted fan unit. It features easy-to-build construction using balsa and plywood. It can be easily modified to accept a wide range of 65 to 70mm EDF units. WS: 37.5 in.; L: 28.25 in.; power: Himax Elf 69 EDF brushless motor; 1 sheet; LD 2

X10091; $14.95

JETS

Turbinator-E

Designed by Nick Ziroli Sr., this is a smaller e-powered version of his 72-inch, turbine-powered jet. It uses traditional balsa-and-plywood construction and has plug-in wing panels. It can be built with fixed gear or retracts. A formed plastic canopy and aileron servo covers are available. WS: 40 in.; L: 43.5 in.; power: Astro 020 w/Wemotec Mini 480 fan unit; 2 sheets; LD 2

X0908A; $21.95

To order: Visit AirAgeStore.com or call 888-235-2021

JETS

Vought A-7D Corsair II

Designed by Le Phan, the Vought A-7D Corsair II is an electric-powered pusher jet that looks great in the air and is very docile to fly. It uses string-and-former construction formed over a crutch and is fully sheeted with balsa. WS: 23.5 in.; L: 27.7 in.; power: Mega 16/15/7 brushless motor; 1 sheet; LD 2

X1106A; $14.95

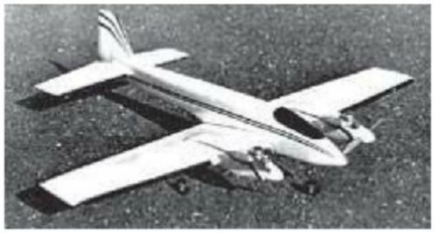
PATTERN

Curare

This Hanno Prettner design features an anhedral stab. Wood-and-foam construction features many rare and unusual design elements. WS: 60 in.; L: 56 in.; engine: .60; radio: 5 channels; 1 sheet; LD 2

X12761; $19.95

PATTERN



Fifty Caliber

This pattern-ship-like twin-engine design features easy construction using traditional balsa and plywood. Designed by Dick Sarpolus, it has excellent flight characteristics and has tricycle landing gear for well-mannered ground handling. WS: 58 in.; L: 49.5 in.; area: 550 sq. in.; engine: two .25; radio: 4 channels; 1 sheet; LD 3

X09802; $19.95

PATTERN

Kaos 90

A 25 percent enlargement of Joe Bridi's original design by Dewey Newbold and James Cumming. WS: 73.5 in.; L: 69 in.; engine: .90; radio: 4 channels; 2 sheets; LD 2

X11841; $19.95

PATTERN

Kwik-Fli Mk III

First published in MAN in 1968, this airplane is still built and flown today. Construction features slab-side fuselage and a D-tube, built-up wing; this Phil Kraft design is eligible for VR/CS events. WS: 60 in.; L: 52 in.; engine: .60; radio: 4 channels; 2 sheets; LD 2

X02681; $19.95

PATTERN

Mach I

Norm Page's Mach I cut a wide swath in 1973 when its many pattern wins won it a place on the U.S. World Team; it could easily do so again today. Employs typical pattern-building techniques in balsa and foam. WS: 62 in.; L: 56 in.; engine: .60; radio: 5 channels; 1 sheet; LD 2

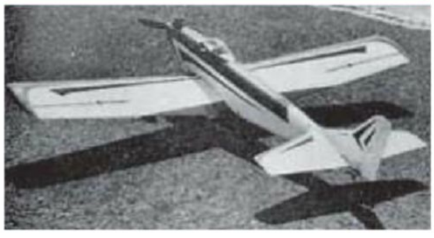
X06733; $19.95

PATTERN

Omen III

Designed by Mark Rittinger, the Omen III is a modern, electric-powered version of Don Wilke's popular 1960s-era Omen II. The new RC pattern/sport flier uses modern construction techniques with traditional balsa, lite-ply, and plywood parts. It has fixed landing gear and is intended for 600W electric-power systems and a 4S LiPo flight pack. WS: 63.5 in.; L: 48.81 in.; power: 600W electric; 1 sheet; LD 2 **X0615A; $16.95**

PATTERN



Orion

This Ed Kazmirski design is the granddaddy of full-house pattern airplanes; still a potent performer and ideal for VR/CS events. It is constructed of a conventional sheet-balsa fuselage and built-up wing. WS: 64 in.; L: 46 in.; engine: .60; radio: 4 channels; 2 sheets; LD 2

X06601; $14.95

SPORT

Lyka Jet

Designed by Jack Zimmanck, this low-tech, high-speed sport flier has jetlike lines. Construction is fast and easy using foam wing cores and square, PVC downspout material from the hardware store for the fuselage. Can be built with or without landing gear. WS: 50.5 in.; L: 43.5 in.; engine: .40 to .45 two-stroke; radio: 4 channels; 1 sheet; LD 2

X11971; $12.95

LEVEL OF DIFFICULTY **LD 1** = beginner **LD 2** = beginner to intermediate **LD 3** = intermediate to advanced **LD 4** = advanced

SPORT

SkyEye

Designed by Clark Salisbury, the SkyEye is a mix of old and new. It is a lightweight, easy-to-build 3-channel sport flier specially designed to have an FPV video camera installed in its nose. Its pusher-propeller design makes a stable platform for shooting aerial photography with lightweight cameras setups. It uses typical balsa-and-plywood construction throughout. WS: 69 in.; L: 53 in.; power: 25-size brushless motor; 2 sheets; LD 2 **K0315A; $23.95**

SPORT

Snoopy's Doghouse

A true collector's item! The original flying Snoopy's Doghouse designed by Al Signorino in balsa and hardwood. This wonder actually flies! WS: 24 in.; L: 25 in.; engine: .60; 1 sheet; LD 2

X04713; $19.95

SPORT

SportStar

Designed by Simon Delaney, this sport flier can be built with either a foam-core wing or a traditional built-up balsa wing construction. The plans show foam-cutting templates and all the balsa rib patterns with building tabs attached. It uses simplified construction methods and uses commercially available hardware, like landing gear, cowl, and canopy. WS: 74 in.; power: 1.20 four-stroke or 20 to 30cc gas; radio: 4 channels; 2 sheets; LD 2 **X1110A; $21.95**

SPORT

Super Hots

This .40- to .60-size Dan Santich fun-fly model is the king of the sky. Plans feature full-size patterns for quick and easy construction out of balsa and ply. WS: 54 in.; L: 51 in.; area: 702 sq. in.; engine: .40 to .61; radio: 4 channels; 1 sheet; LD 2

X02861; $19.95

SPORT

The Hots

A winning fun-fly RC design by Dan Santich, this simple, quick-to-build, all-balsa model is an outstanding aerobatic performer but quite stable. WS: 48 in.; L: 29.5 in.; power: E-flite Power 10 Outrunner; 1 sheet; LD 2

X04841; $19.95

SPORT

The Pharaoh

Designed by Mark Rittinger, the Pharaoh is an electric-powered sport aerobatic design, which uses commercially available foam wing cores to speed construction. The rest of the model uses traditional balsa, light ply, and aircraft plywood construction. All hardware is available at your local hobby shop. WS: 54 in.; L: 48.75 in.; power: 750Kv brushless motor; 1 sheet; LD 2

X0416A; $16.95

SPORT

The Ringmaster

Designed by Nick Ziroli Sr., this RC conversion of the 1951 Harry Williamson control-line stunt design is conventional balsa and ply. WS: 54 in.; L: 39 in.; engine: .40 to .50 two-stroke or .45 to .60 four-stroke; radio: 4 channels; 1 sheet; LD 2

X08971; $9.95

SPORT

The Wild Hots

Developed by Steve Santich, the Wild Hots is based on the original Hots designed by his father, Dan Santich. It is a lightweight-profile balsa-and-ply aerobat, and it is electric powered. It can perform 3D aerobatics, and it can land as slowly as a trainer. WS: 40.5 in.; L: 43 in.; power: E-flite Power 10 Outrunner; 1 sheet; LD 2

X02091; $14.95

SPORT

Wild Thing .40

This Tom Stryker design has a short wingspan for fast roll rates and is practically stall-proof. It flies extremely well at low speeds and can practically hover in a light breeze. For intermediate builders/fliers. WS: 48 in.; L: 41 in.; engine: .35 to .45 two-stroke; 1 sheet; LD 2

X04911; $19.95

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10561090

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FREE
WITH ANY PURCHASE

PITTSBURGH
6 PIECE SCREWDRIVER SET
ITEM 61313/62728
62583/47770/62570 shown

$7.97 VALUE

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10571213

WOW SUPER COUPON

US GENERAL
30", 5 DRAWER TOOL CART
ITEM 95272 shown
63308/69397/61427

Customer Rating ★★★★★

• 704 lb. capacity

SAVE $230

$169.99
$189.99
comp at $399.99

10551239

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SUPER COUPON

SAVE 66%
72" x 80" MOVING BLANKET
HaulMaster
ITEM 66537 shown
69505/62418

Customer Rating ★★★★★

$5.99
$8.99
comp at $17.97

10548516

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SUPER COUPON

12 VOLT, 10/2/50 AMP BATTERY CHARGER/ ENGINE STARTER
Customer Rating ★★★★½
CEN-TECH
ITEM 60581
60653 shown

SAVE 57%

$29.99
$49.99
comp at $69.99

10569554

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WOW SUPER COUPON

RAPID PUMP® 3 TON LOW PROFILE HEAVY DUTY STEEL FLOOR JACK
PITTSBURGH
ITEM 61282 shown
61253/62326

• Weighs 73 lbs.

SAVE $180

Customer Rating ★★★★★

$89.99
$99.99
comp at $269.99

10552514

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WOW SUPER COUPON

16 OZ. HAMMERS WITH FIBERGLASS HANDLE
SAVE 77%
PITTSBURGH
CLAW ITEM 69006 60715/60714
RIP ITEM 47873 shown 69005/61262

Customer Rating ★★★★★

YOUR CHOICE $3.99
$4.99
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10587686

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SUPER COUPON

12,000 LB. ELECTRIC WINCH WITH REMOTE CONTROL AND AUTOMATIC BRAKE
ITEM 61256/61889
60813 shown

BADLAND

Customer Rating ★★★★★

SAVE $453

$299.99
$399.99
comp at $752.99

10545575

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SUPER COUPON

4-1/2" ANGLE GRINDER
drillmaster
ITEM 60625 shown
95578/69645

SAVE 40%

Customer Rating ★★★★★

$11.99
$14.99
comp at $20.26

10593583

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SUPER COUPON

PREDATOR GENERATORS
4000 PEAK/ 3200 RUNNING WATTS 6.5 HP (212 CC) GAS GENERATORS
SUPER QUIET
ITEM 63079/69729/63080/69676 shown
ITEM 69675/69728/63090/63089 CALIFORNIA ONLY

SAVE $179

Customer Rating ★★★★½

• 70 dB Noise Level

$289.99
$339.99
comp at $469

10595488

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SUPER COUPON

one stop gardens
SOLAR ROPE LIGHT
ITEM 62533/68353 shown

Customer Rating ★★★★★

SAVE 66%

• 16 ft. lit, 22 ft. long

$9.99
$13.99
comp at $29.97

10600015

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SUPER COUPON

18 VOLT CORDLESS 1/2" DRILL/DRIVER WITH KEYLESS CHUCK
CHICAGO ELECTRIC POWER TOOLS

Includes one 18V NiCd battery and charger.

SAVE $59

$39.99
ITEM 62427
63059
68850 shown
$49.99
comp at $99

10558048

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SUPER COUPON

STEP STOOL/ WORKING PLATFORM
HaulMaster
ITEM 62515
66911 shown

Customer Rating ★★★★½

350 lb. capacity

SAVE 65%

$19.99
$29.99
comp at $57.55

10557376

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WOW SUPER COUPON

3 GALLON, 100 PSI OILLESS AIR COMPRESSORS
CENTRAL PNEUMATIC

A. HOT DOG ITEM 69269 97080 shown
B. PANCAKE ITEM 95275 shown 60637/61615

Customer Rating ★★★★½

SAVE 59%

YOUR CHOICE $39.99
$59.99
comp at $98.62

10601754

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WOW SUPER COUPON

SAVE 70%
9 PIECE FULLY POLISHED COMBINATION WRENCH SETS
Customer Rating ★★★★½
PITTSBURGH
SAE ITEM 69043/63282 42304 shown
METRIC ITEM 42305 69044/63171

YOUR CHOICE $5.99
$8.99
comp at $19.97

10604589

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SUPER COUPON

SAVE $228
6.5 HP (212 CC) OHV HORIZONTAL SHAFT GAS ENGINES
PREDATOR ENGINES
ITEM 60363/69730

Customer Rating ★★★★★

ITEM 68121/69727 shown
CALIFORNIA ONLY

$99.99
$119.99
comp at $328

10577439

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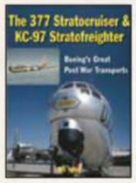

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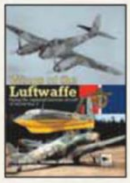

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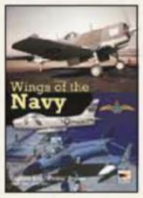

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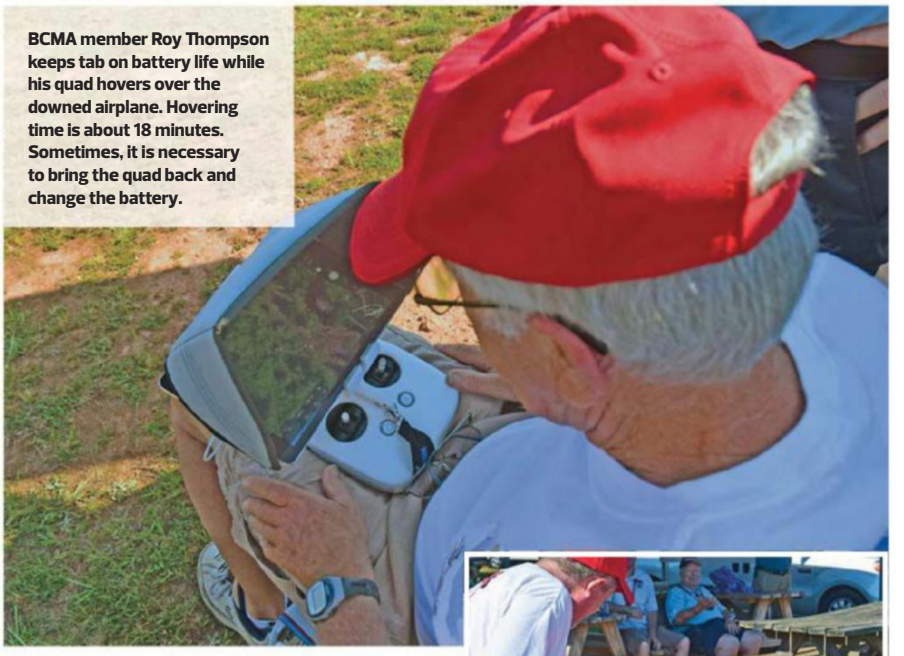
Final Approach

TEXT & PHOTOS BY **JERRY SMITH**

Quads to the Rescue!



BCMA member Roy Thompson keeps tab on battery life while his quad hovers over the downed airplane. Hovering time is about 18 minutes. Sometimes, it is necessary to bring the quad back and change the battery.

Bartow County Model Aviation (BCMA) RC club, a group of 60 members located in Emerson, Georgia, has found a new way to rescue downed airplanes. But before I tell you, let me explain about the territory they fly over. They have a 650 x 100-foot runway that's well manicured; however, it's surrounded by complete wilderness: heavy brush, blackberry bushes with nasty thorns, small pine trees, and that fast-growing kudzu. Tromping around that stuff on a hot summer day looking for an airplane is certainly not at the top of one's to-do list. It is not easy to go in a straight line to where you thought the plane went in because you have to go around the heavy brush, so it's easy to lose your way. Looking at my aerial of the site will let you see the conditions that exist there. Many other club sites are on farmlands surrounded by corn and wheat fields. I can remember looking for a downed airplane in a cornfield—not an easy find.

The retrieved airplane belonging to Ron Nonig shows a lot of damage to the nose. It was difficult to repair, so the club bought him a new one.

Airplane recovered! Here's the quad pilot's view of the downed airplane. He hovers over the airplane so that those searching can tell where the airplane is located below. Note the fellow in the red hat. He is deep in brush and still can't see the downed airplane.

The aerial view of the site shows how much wilderness surrounds the site. The railroad at the top of the image has very steep embankments surrounded by deep kudzu.

Eight or nine members in the club fly quads, mostly DJI Phantoms and a few of the other types. It seems as if they are always around when a plane goes in and willing to help and show off their skills with their quads. Most of the time an airplane goes in because of pilot error. Here is the unique way they retrieve downed airplanes at BCMA. When an airplane goes in, the direction is noted. A quad is fired up and heads slowly in that direction at about a 50-foot altitude with its camera pointed down. Once the plane is spotted, the quad hovers over it so that those on the ground can walk toward the quad. Bright-colored airplanes are easy to spot, but planes with colors like gray, black, or green are more difficult to spot. To date, 10 airplanes have been found at BCMA using the quad, with 100 percent success. If your flying field has conditions such as I have described, you might try finding your downed airplane with a quad. It is working great for the BCMA RC club.

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